**Emergency Roof Repairs**
**538-12-110**
**Project Specifications**
(1/27/2012)

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**SECTION 00 01 15**
**LIST OF DRAWING SHEETS**

The drawings listed below accompanying this specification form a part of the contract, for Project 538-12-110 EMERGENCY ROOF REPAIRS.

| Drawing No. | Drawing Title |
|---|---|
| 2012-1.1 | Cover Sheet, Misc Details & Sections |
| 2012-1.2 | Roof Plan Building 9 |
| 2012-1.3 | Roof Plan Building 31 |
| 2012-1.4 | Roof Plan Building 21 |
| 2012-1.5 | Roof Plan Building 35 |

**- - - END - - -**

**SECTION 01 00 00**
**GENERAL REQUIREMENTS**

## 1.1 GENERAL INTENTION

A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor, materials and equipment necessary to perform work for project 538-12-110, entitled EMERGENCY ROOF REPAIRS at VAMC, Chillicothe, Ohio, as required by drawings and specifications.

B. Visits to the site by Bidders shall be as outlined in the project specifications.

C. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.

D. Prior to commencing work, general contractor shall provide proof that an OSHA Construction Outreach “competent person” (CP) (29 CFR 1926.32(f) will maintain a presence at the work site whenever the general or subcontractor(s) are present.

E. Training:

1. All employees of general contractor or subcontractors shall have the 10-hour OSHA Construction Outreach Safety course and/or other relevant competency training, as determined by VA CP with input from the VA Infection Control Risk Assessment (IRCA) team.

2. Submit all related training records of all such employees for approval before the start of work.

F. Request for Information:

1. In the event an explanation or interpretation of the drawings or specifications is necessary, submit the request using RFI (Request for Information) Form included in the EXHIBITS SECTION of these specifications. Such requests shall be submitted to the Contracting Officer soon enough to allow a reply so as to effect the project as little as possible.

## 1.2 STATEMENT OF BID ITEM(S)

A. BID ITEM I (BASE BID): Contractor shall completely prepare the site for building operations, including demolition and removal of existing structures, and furnish labor, materials and equipment necessary to perform EMERGENCY ROOF REPAIRS on Building 9, 21, 31 and 35, at VAMC, Chillicothe, Ohio as required by drawings and specifications. Work to be completed within **150** calendar days after receipt of Notice to Proceed.

**It is the intent of the Government that award will be made on the Base Bid; however, should the bids for the base bid exceed the funds available, award may be made on the Base Bid and one or more of the following deduct items.**

B. BID ITEM II: (Alternate Deduct I): Same as BID ITEM I, except install new asphalt shingles on Building 31 and provide VA with removed clay tile shingles loaded on pallets. Work to be completed within **150** calendar days after receipt of Notice to Proceed.

C. BID ITEM III: (Alternate Deduct II): Same as BID ITEM II, except **DELETE** work related to new scupper boxes and downspouts at Building 31 as outlined on project drawings and specifications. Work to be completed within **120** calendar days after receipt of Notice to Proceed.

**1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR**

A. AFTER AWARD OF CONTRACT, additional sets of drawings may be made by the Contractor, at Contractor's expense, from reproducibles furnished by the Planning and Design Office. Such reproducibles shall be returned to the Planning and Design Office immediately after printing is completed.

**1.4 FIRE AND SAFETY PRECAUTIONS**

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

1. American Society for Testing and Materials (ASTM):

E84-1998.....Surface Burning Characteristics of Materials

2. National Fire Protection Association (NFPA):

10-1998.....Standard for Portable Fire Extinguishers

FCLCH-30-2000.....Flammable and Combustible Liquids Code

51B-1999.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2000.....National Electric Code

241-2000.....Standard for Safeguarding Construction, Alterations and Demolition Operations

3. Occupational Safety and Health Administration (OSHA):

29 CFR 1926.....Safety and Health Regulations for Construction

29 CFR 1910.....Safety and Health Regulations for General Industry

B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926 and NFPA. Prior to start of work, prepare a plan detailing project-specific fire

safety measures, including periodic status reports, and submit to Project Engineer for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing (toolbox talks) provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the Project Engineer that individuals have undergone contractor's safety briefing. A monthly status report shall be provided during the entire construction detailing the status of each measure.

C. The contractor is to keep all tools and equipment under his direct, personal control so that no unauthorized use of tools and equipment can occur.

D. All tools, equipment, and materials are to be placed within locked, physically secure, and weather proof enclosures at the end of each workday.

E. Site and Building Access: Exits for VA occupied areas of a building including rooms, suites, corridors and floors shall not be blocked by the construction or by construction materials in accordance with NFPA 241. Exits may be blocked temporarily if it is unavoidable and adequate alternate measures are provided such as signage, instructions to occupants.

F. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connection. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Project Engineer. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested by the Contractor in the presence of the Project Engineer. Parameters for the testing shall be approved by the Project Engineer. Results of any tests performed shall be recorded by the Contractor and copies provided to the Project Engineer.

G. All work areas are to be kept clear of accumulated debris at all times in accordance with NFPA 241. At the end of each workday, combustible packaging and crating materials for building products and equipment to be installed shall be removed from construction area, stored in approved container or area, until removal from station by contractor. All work areas are to be in a broom clean condition at the end of each workday.

H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

I. As required by the Joint Commission on Accreditation of Healthcare Organizations, smoking shall be prohibited in or adjacent to all construction areas in existing buildings. Smoking shall

be prohibited at or near or throughout project areas. See Medical Center Smoking Policy located in the EXHIBITS SECTION of the Specifications.

J. Weekly fire and safety hazard inspections shall be conducted by the contractor once construction starts and until the project is turned over to the Government. A report shall be provided to the Project Engineer listing all hazards and corrective actions taken.

K. Temporary structures, including trailers that are used for storage or offices, shall be a minimum of 30 feet from any VA occupied building in accordance with NFPA 241. Location of temporary structures must have approval of the Contracting Officer's Technical Representative.

L. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

M. All flammable liquids shall be handled, stored and used in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

N. Maintain construction site to permit access of fire department vehicles as necessary. Clear building construction areas of unnecessary obstructions so that all portions are accessible for fire department apparatus and permit emergency egress of construction and other personnel.

O. All necessary precautions shall be taken by the contractor to prevent accidental operation of any existing smoke detectors by minimizing the amount of dust generated in the vicinity of any smoke detectors.

P. All construction activities not already covered above shall be in accordance with NFPA 241.

Q. Perform other construction, alterations and demolition operations in accordance with 29CFR 1926/1910.

R. The contractor shall notify the Contracting Officer, in writing, of any on-site job related injuries/illnesses which occur during performance of work under this contract. This notification is to be provided to the Contracting Officer as soon as possible but not later than 24 hours after the incident occurs.

**1.5 OPERATIONS AND STORAGE AREAS**

**NOTE:** The following paragraphs are in addition to FAR 52.236-10 Clause OPERATIONS AND STORAGE AREAS.

A. The contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the government. Location of temporary buildings must have approval of the Contracting Officer's Technical Representative. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work.

C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, roads and lawn areas.

D. Working space and space available for storing materials shall be as shown on the drawings and as determined by the Project Engineer.

E. Workmen are subject to rules of Medical Center applicable to their conduct.

F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by Project Engineer where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.

2. Schedule delivery of materials and equipment to immediate construction working areas in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.

G. Phasing: To insure such executions, Contractor shall furnish the Project Engineer with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building, or portion thereof. In addition, Contractor shall notify the Project Engineer two weeks in advance of the proposed date of starting work in each specific area of site, building, or portion thereof.

H. All buildings will be occupied by Medical Center personnel continuously during the work of this project. The Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and

debris, so that equipment and affected areas to be used in the Medical Center's operations will not be hindered. Contractor shall permit (safe) access to Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that hospital operations will continue during the construction period.

I. Construction Fence: Before any exterior construction operations begin, Contractor shall provide a construction fence around the construction area. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fencing shall be four foot minimum height metal material with non-penetrating type metal posts and shall be substantial in construction and design. Details of fence construction and erection thereof shall be submitted to Project Engineer for approval. Contractor shall be required to maintain integrity of construction fence for the duration of project work. Remove the fence when directed/approved by the Project Engineer.

J. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services, or of fire protection systems or communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by Project Engineer.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of Project Engineer.

2. Contractor shall submit a request to interrupt any such services to Project Engineer, in writing, five (5) working days in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.

3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.

4. In case of a contract construction emergency, services will be interrupted on approval of Project Engineer. Such approval will be confirmed in writing as soon as practical.

5. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the Project Engineer.

K. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished

areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

L. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:

1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.

2. Method and scheduling of required closing of existing walks and entrances must be approved by the Project Engineer.

M. Coordinate the work for this contract with other construction operations as directed by Project Engineer. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

N. Hours of Work: The work of this contract is to be executed between 8:00 a.m. and 4:30 p.m., Monday through Friday, except as required by the specifications and/or otherwise authorized by the Project Engineer. Work in occupied spaces shall be scheduled at times convenient to the occupant and the Medical Center. No work will be performed on Government recognized holidays, except as required by the specifications and/or otherwise authorized by the Project Engineer.

O. Keys: Any keys necessary to gain entry to work areas or other spaces associated with performing work will be issued to the Contractor's representative on a daily basis. Keys will be signed out after 7:30 a.m. and returned before 4:30 p.m. from the Engineering Office, Building 21, each day when necessary to gain access. Failure to return any issued keys may result in a charge to include costs to re-key areas associated with the keys involved.

P. Badges: All Contractor personnel shall be issued a Temporary ID Badge from the Engineering Office, Building 21. These ID badges shall be worn at all times while on the VA property. At the end of the project work or, when a Contractor employee will no longer work on the site, the ID Badges shall be returned to the Engineering Office. Failure to return any ID badges may result in a charge for said ID badges.

**1.6 ALTERATIONS**

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the Project Engineer and a representative of VA Acquisition and Materiel Management Service of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by all three, to the Contracting Officer. This report shall list by rooms and spaces:

1. Existing condition and types of sidewalks, roadways, lawn areas and other surfaces not required to be altered throughout affected areas of buildings.
2. Shall note any discrepancies between drawings and existing conditions at site.
3. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and the Project Engineer.

B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of Project Engineer and Acquisition and Materiel Management Service, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) of Section GENERAL CONDITIONS.

C. Re-Survey: Fifteen days before expected partial or final inspection date, the Contractor and Project Engineer together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report.

1. Re-survey report shall also list any damage caused by Contractor to such sidewalks, roadways, lawn areas and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.

D. Protection: Provide the following protective measures:

1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. This protection shall be maintained intact until all work in the area is completed.
4. Dampen debris to keep down dust. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.

a. When local building code requires temporary closures to have a fire rating, the design of the closures and the materials of which they are constructed shall be such as will provide the required fire rating.

**1.7 INFECTION PREVENTION MEASURES**

A. Implement the requirements of VAMC's Infection Control Assessment (ICRA) team. IRCA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.

B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group as specified here. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to Project Engineer thru the Contracting Officer for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the Medical Center.

C. Medical Center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the Medical Center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:

1. The Project Engineer and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the Contractor shall implement corrective measures to restore proper pressure differentials as need.

2. In case of any problem, the Medical Center, along with assistance from the Contractor, shall conduct an environmental assessment to find and eliminate source.

D. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.

1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by Project Engineer. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.

2. Do not perform dust producing tasks within occupied areas without the approval of the Project Engineer. For construction in any areas that will remain jointly occupied by the Medical Center and Contractor's workers, the Contractor shall:

a. Provide dust proof one-hour fire-rated temporary drywall construction barriers to completely separate construction from operational areas of the hospital in order to contain dirt debris and dust. Barrier shall be sealed and made presentable on hospital occupied side. Install a self-closing rated door in a metal frame, commensurate with the partition, to allow worker access. Maintain negative air pressure at all times. A fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the Project Engineer and the Medical Center.

b. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that the dust is not reinforced into the medical center.

c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 24” x 36”, shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside the construction area at all times.

d. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport debris outside the construction area in containers with tightly fitting lids.

e. The contractor shall not haul debris through patient-care areas without prior approval of the Project Engineer and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.

f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.

g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All

accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.

h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

E. Final Cleanup:

1. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.

**1.8 DISPOSAL AND RETENTION:**

A. Materials and equipment accruing from work removed and from demolition of structures, or parts thereof, shall be disposed of as follows:

1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored. Items which remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to reinstallation and reuse. Store such items where directed by Project Engineer.

2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.

3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

**1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS**

**NOTE:** The following paragraph is in addition to FAR 52.236-9 Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS.

A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not reasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workman, the

Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree pruning compound as directed by the Contracting Officer.

B. Refer to Articles, "Alterations," "Restoration," and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

**1.10 RESTORATION**

A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the Project Engineer. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the Project Engineer before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.

C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.

**1.11 AS-BUILT DRAWINGS**

A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.

B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the Project Engineer’s review, as often as requested.

C. Contractor shall deliver two approved completed sets of as-built drawings to the Project Engineer within 15 calendar days after each completed phase and after acceptance of the project by the Project Engineer.

D. Paragraphs A, B, and C shall also apply to all shop drawings.

**1.12 USE OF ROADWAYS**

For hauling, use only established public roads and roads on Medical Center property and, when authorized by the Project Engineer, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

**1.13 TEMPORARY TOILETS**

Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

**1.14 AVAILABILITY AND USE OF UTILITIES**

**NOTE:** The following paragraphs are in addition to FAR 52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES.

A. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials.

1. Obtain heat by connecting to Medical Center heating distribution system.

a. Steam is available at no cost to Contractor.

B. Electricity (for Construction and Testing): Furnish all temporary electric services.

1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.

C. Water (for Construction and Testing): Furnish temporary water service.

1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.

2. Maintain connections, pipe, fittings and fixtures, and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at Project Engineer's discretion) of use of water from Medical Center's system.

D. Steam: Furnish steam system for testing required in various sections of specifications.

1. Obtain steam for testing by connecting to the Medical Center steam distribution system. Steam is available at no cost to the Contractor.

2. Maintain connections, pipe, fittings and fixtures and conserve steam-use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at Project Engineer's discretion), of use of steam from the Medical Center's system.

**1.15 HISTORIC PRESERVATION**

Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the Project Engineer verbally, and then with a written follow up.

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**SECTION 01 33 23**
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

**1.1** Refer to article titled "Specifications and Drawings for Construction" (FAR 52.236-21) in Section GENERAL CONDITIONS.

**1.2** For the purposes of this contract, samples, laboratory samples to be tested, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all such items collectively as SUBMITTALS.

**1.3** Submit for approval, all of the items specifically mentioned under the separate sections of the specification with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:

A. Satisfactory written evidence is presented to and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;

B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;

C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.

**1.4** Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submissions to assure adequate lead time for procurement of contract-required items. Delays attributable to untimely and rejected submittals (including any laboratory samples to be tested) will not serve as a basis for extending contract time for completion.

**1.5** Samples, shop drawings, certificates, and manufacturers' literature and data will be reviewed for compliance with the contract requirements and action thereon will be taken by Project Engineer on behalf of the Contracting Officer.

**1.6** The Government reserves the right to require submission of samples, certificates, literature, data, schedules and details, and shop, erection or setting drawings whether or not particularly mentioned herein. If additional submittals beyond those required by contract are furnished pursuant to request therefore by Contracting Officer, adjustment in contract price and time will be made in accordance with clause entitled "CHANGES" (FAR 52.243-4) and "CHANGES - SUPPLEMENT" (VAAR 852.236-88) of Section GENERAL CONDITIONS.

**1.7** Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Contracting Officer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer assumes no responsibility for

checking schedules or layout drawings for exact sizes, exact numbers, and detailed positioning of items.

**1.8** Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.

A. Submittals will receive consideration only when covered by a Transmittal Letter signed by Contractor. Transmittal Letter shall be sent via first-class mail and shall contain the Name of Contractor, Contract Number, Specification Section Number, Project Title and Location, Item Number, Description of Item, Type of Submittal, Applicable Specification Paragraph Numbers, Applicable Authorities' Numbers (Fed. Spec. No., ASTM No., ACI No., etc), and such additional information as may be required for exact identification and location for each item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.

1. A copy of the Transmittal Letter must be enclosed with items, and any items received without the Transmittal Letter will be considered "unclaimed goods" and held for a limited time only.

2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name of the Station, name of Contractor, manufacturer, brand, contract number, and ASTM or Federal Specification Number as applicable, and location(s) on project.

3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.

B. In addition to complying with the applicable requirements specified in preceding Subparagraph 1.8.A, samples which are required to have Laboratory Tests under the separate sections of the specification shall be tested, at expense of Contractor, in a commercial laboratory approved by Contracting Officer.

1. Laboratory shall furnish Contracting Officer with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials, and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.

2. Certificates shall also set forth a list of comparable projects for which laboratory has performed similar functions during past five years.

3. Samples for laboratory tests shall be sent directly to approved commercial testing laboratory.

4. Contractor shall send a copy of Transmittal Letter to Contracting Officer simultaneously with submission of material to a commercial testing laboratory.

5. Laboratory test reports shall be sent directly to Contracting Officer for appropriate action.

6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.

7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.

C. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in Transmittal Letter.

D. Approved samples will be kept on file by Project Engineer at site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.

E. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.

1. For each drawing required, submit one legible photographic paper or vellum reproducible.

2. Reproducible shall be full size.

3. Each drawing shall have marked thereon, proper descriptive title, including station location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.

4. A space 4-3/4 by 5 inches shall be reserved on each drawing to accommodate approval or disapproval stamp.

5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.

6. One reproducible print of approved and disapproved shop drawings will be forwarded to Contractor.

7. When work is directly related and involves more than one trade, shop drawings shall be submitted to the Contracting Officer under one cover.

**1.9** Submit samples (except laboratory samples), shop drawings, test reports, certificates and manufacturers' literature and data, as required by individual sections of the specification, for

approval to the Contracting Officer (90C), Department of Veterans Affairs Medical Center, 17273 State Route 104, Chillicothe, Ohio 45601.

**- - - E N D - - -**

**SECTION 01 42 19**
**REFERENCE STANDARDS**

## PART 1 - GENERAL

### 1.1 DESCRIPTION

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

### 1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)

A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to – GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.

B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

### 1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
811 Vermont Avenue, NW - Room 462
Washington, DC 20420
Telephone Number: (202) 565-5214
Between 9:00 AM - 3:00 PM

### 1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

| | |
|---|---|
| AA | Aluminum Association Inc.<br>http://www.aluminum.org |
| AASHTO | American Association of State Highway and Transportation Officials<br>http://www.aashto.org |
| ACGIH | American Conference of Governmental Industrial Hygienists<br>http://www.acgih.org |
| ACI | American Concrete Institute<br>http://www.aci-int.net |
| AGC | Associated General Contractors of America<br>http://www.agc.org |
| AITC | American Institute of Timber Construction<br>http://www.aitc-glulam.org |
| ANLA | American Nursery & Landscape Association<br>http://www.anla.org |
| ANSI | American National Standards Institute, Inc.<br>http://www.ansi.org |
| APA | The Engineered Wood Association<br>http://www.apawood.org |
| ASTM | American Society for Testing and Materials<br>http://www.astm.org |
| AWI | Architectural Woodwork Institute<br>http://www.awinet.org |
| CLFMI | Chain Link Fence Manufacturers Institute<br>http://www.chainlinkinfo.org |
| CPMB | Concrete Plant Manufacturers Bureau<br>http://www.cpmb.org |
| CRA | California Redwood Association<br>http://www.calredwood.org |
| CRSI | Concrete Reinforcing Steel Institute<br>http://www.crsi.org |
| EEI | Edison Electric Institute<br>http://www.eei.org |

| | |
|---|---|
| EPA | Environmental Protection Agency<br>http://www.epa.gov |
| FPS | The Forest Products Society<br>http://www.forestprod.org |
| HPVA | Hardwood Plywood & Veneer Association<br>http://www.hpva.org |
| NBS | National Bureau of Standards<br>See - NIST |
| NEC | National Electric Code<br>See - NFPA National Fire Protection Association |
| NFPA | National Fire Protection Association<br>http://www.nfpa.org |
| NHLA | National Hardwood Lumber Association<br>http://www.natlhardwood.org |
| NIH | National Institute of Health<br>http://www.nih.gov |
| NIST | National Institute of Standards and Technology<br>http://www.nist.gov |
| NLMA | Northeastern Lumber Manufacturers Association, Inc.<br>http://www.nelma.org |
| OSHA | Occupational Safety and Health Administration<br>Department of Labor<br>http://www.osha.gov |
| PCA | Portland Cement Association<br>http://www.portcement.org |
| SCMA | Southern Cypress Manufacturers Association<br>http://www.cypressinfo.org |
| SMACNA | Sheet Metal and Air-Conditioning Contractors<br>National Association, Inc.<br>http://www.smacna.org |
| SSPC | The Society for Protective Coatings<br>http://www.sspc.org |

TPI Truss Plate Institute, Inc.
583 D'Onofrio Drive; Suite 200
Madison, WI 53719
(608) 833-5900

UBC The Uniform Building Code
See ICBO

UL Underwriters' Laboratories Incorporated
http://www.ul.com

ULC Underwriters' Laboratories of Canada
http://www.ulc.ca

**- - - E N D - - -**

**SECTION 01 45 29**
**TESTING LABORATORY SERVICES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor. The individual testing and inspection activities are identified in project technical specifications.

**1.2 APPLICABLE PUBLICATIONS:**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

A325-06.....Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A370-07.....Definitions for Mechanical Testing of Steel Products

A416/A416M-06 .....Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

A490-06.....Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength

C31/C31M-06.....Making and Curing Concrete Test Specimens in the Field

C33-03 .....Concrete Aggregates

C39/C39M-05.....Compressive Strength of Cylindrical Concrete Specimens

C109/C109M-05.....Compressive Strength of Hydraulic Cement Mortars

C138-07 .....Unit Weight, Yield, and Air Content (Gravimetric) of Concrete

C140-07 .....Sampling and Testing Concrete Masonry Units and Related Units

C143/C143M-05.....Slump of Hydraulic Cement Concrete

C172-07 .....Sampling Freshly Mixed Concrete

C173-07 .....Air Content of freshly Mixed Concrete by the Volumetric Method

C330-05 .....Lightweight Aggregates for Structural Concrete

C567-05 .....Density Structural Lightweight Concrete

C780-07 .....Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

C1019-08 .....Sampling and Testing Grout

C1064/C1064M-05.....Freshly Mixed Portland Cement Concrete

C1077-06 .....Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

C1314-07 .....Compressive Strength of Masonry Prisms

D698-07 .....Laboratory Compaction Characteristics of Soil Using Standard Effort
E94-04.....Radiographic Testing
E164-03.....Ultrasonic Contact Examination of Weldments
E329-07.....Agencies Engaged in Construction Inspection and/or Testing
E543-06.....Agencies Performing Non-Destructive Testing
E605-93(R2006) .....Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
E709-(2001) .....Guide for Magnetic Particle Examination
E1155-96(R2008) .....Determining FF Floor Flatness and FL Floor Levelness Numbers

E. American Welding Society (AWS):
D1.1-07 .....Structural Welding Code-Steel

**1.3 REQUIREMENTS:**

A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E 329, C 1077, D 3666, D3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Project Engineer to such failure.

C. Written Reports: Testing laboratory shall submit test reports to Project Engineer, Contractor, unless other arrangements are agreed to in writing by the Project Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to Project Engineer immediately of any irregularity.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 GENERAL:**

The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified in project technical specifications.

**- - - E N D - - -**

**SECTION 01 74 19**
**CONSTRUCTION WASTE MANAGEMENT**

## PART 1 – GENERAL

### 1.1 DESCRIPTION

A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.

B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.

C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:

1. Waste Management Plan development and implementation.
2. Techniques to minimize waste generation.
3. Sorting and separating of waste materials.
4. Salvage of existing materials and items for reuse or resale.
5. Recycling of materials that cannot be reused or sold.

D. At a minimum the following waste categories shall be diverted from landfills:

1. Soil.
2. Inerts (eg, concrete, masonry and asphalt).
3. Clean dimensional wood and palette wood.
4. Green waste (biodegradable landscaping materials).
5. Engineered wood products (plywood, particle board and I-joists, etc).
6. Metal products (eg, steel, wire, beverage containers, etc).
7. Cardboard, paper and packaging.
8. Bitumen roofing materials.
9. Plastics (eg, ABS, PVC).
10. Carpet and/or pad.
11. Gypsum board.
12. Insulation.
13. Paint.

### 1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

### 1.3 QUALITY ASSURANCE

A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction Demolition waste includes products of the following:

1. Excess or unusable construction materials.
2. Packaging used for construction products.
3. Poor planning or layout.
4. Construction error.

5. Over ordering.
6. Weather damage.
7. Contamination.
8. Mishandling.
9. Breakage.

B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.

C. Contractor shall develop and implement procedures to reuse and recycle new materials to a minimum of 50 percent.

D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website http://www.wbdg.org provides a Construction Waste Management Database that contains information on companies that haul. Collect, and process recyclable debris from construction projects.

F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.

H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

**1.4 TERMINOLOGY**

A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.

B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.

C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.

D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.

E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).

F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.

G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.

H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.

I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

1. On-site Recycling – of waste is not permitted.

2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.

M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.

O. Return: To give back reusable items or unused products to vendors for credit.

P. Salvage: To remove waste materials from the site for resale or re-use by a third party.

Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.

R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.

S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

**1.5 SUBMITTALS**

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:

B. Prepare and submit to the Project Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:

1. Procedures to be used for debris management.
2. Techniques to be used to minimize waste generation.
3. Analysis of the estimated job site waste to be generated:

a. List of each material and quantity to be salvaged, reused, recycled.

b. List of each material and quantity proposed to be taken to a landfill.

4. Detailed description of the Means/Methods to be used for material handling.

a. On site: Material separation, storage, protection where applicable.

b. Off site: Transportation means and destination. Include list of materials.

1) Description of materials to be site-separated and self-hauled to designated facilities.

2) Description of mixed materials to be collected by designated waste haulers and removed from the site.

c. The names and locations of mixed debris reuse and recycling facilities or sites.

d. The names and locations of trash disposal landfill facilities or sites.

e. Documentation that the facilities or sites are approved to receive the materials.

B. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.

C. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

**1.6 APPLICABLE PUBLICATIONS**

Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.

A. U.S. Green Building Council (USGBC): LEED Green Building Rating System for New Construction

**1.7 RECORDS**

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

A. List of each material and quantity to be salvaged, recycled, reused.

B. List of each material and quantity proposed to be taken to a landfill.

C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

**PART 3 - EXECUTION**

**3.1 COLLECTION**

A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.

B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.

C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

**3.2 DISPOSAL**

A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.

B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

**3.3 REPORT**

A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.

B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.

C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

**- - - E N D - - -**

**SECTION 02 41 00**
**DEMOLITION**

## PART 1 - GENERAL

### 1.1 DESCRIPTION:

This section specifies demolition and removal of building roofing materials, flashing and sheet metal, and other related items.

### 1.2 RELATED WORK:

A. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

B. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.

### 1.3 PROTECTION:

A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.

C. Maintain fences, barricades, lights, and other similar items around work area until all work has been completed.

D. Provide enclosed dust chutes with control gates from roof to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris. No materials shall be allowed to fall from roof edge to ground.

E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Clean the work area daily of accumulate debris.

F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:

1. Do not block building exits.
2. Keep fire hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place. Any damaged items shall be repaired or replaced as approved by the Project Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Project Engineer's approval.

H. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 – EXECUTION**

**3.1 DEMOLITION:**

A. Debris, including shingles, roofing, metals and similar materials shall become property of Contractor and shall be removed form the immediate work area by him daily, and disposed of off the Medical Center prior to completion of the project. Materials that cannot be removed daily shall be stored in areas specified by the Project Engineer. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

B. Remove and legally dispose of all materials, removed as part of project work. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations.

**3.2 CLEAN-UP:**

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Project Engineer. Clean-up shall include off the Medical Center Property disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

**- - - E N D - - -**

**SECTION 03 30 00**
**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

**1.2 RELATED WORK:**

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

**1.3 TOLERANCES:**

A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).

B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.

C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).

D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:

1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

**1.4 REGULATORY REQUIREMENTS:**

A. ACI SP-66 – ACI Detailing Manual.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ACI 301 – Standard Specifications for Structural Concrete.

**1.5 SUBMITTALS:**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Shop Drawings: Reinforcing steel: Complete shop drawings

C. Mill Test Reports:

1. Reinforcing Steel.
2. Cement.

D. Manufacturer's Certificates:
1. Abrasive aggregate.
2. Lightweight aggregate for structural concrete.
3. Air-entraining admixture.
4. Chemical admixtures, including chloride ion content.
5. Waterproof paper for curing concrete.
6. Liquid membrane-forming compounds for curing concrete.
7. Non-shrinking grout.
8. Liquid hardener.
9. Waterstops.
10. Expansion joint filler.
11. Adhesive binder.

E. Test Report for Concrete Mix Designs: Trial mixes including water-cement // fly ash // ratio curves, concrete mix ingredients, and admixtures.

**1.6 APPLICABLE PUBLICATIONS:**

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Concrete Institute (ACI):

117-10 ..... Tolerances for Concrete Construction and Materials
211.1-91(R2009) ..... Selecting Proportions for Normal, Heavyweight, and Mass Concrete
211.2-98(R2004) ..... Selecting Proportions for Structural Lightweight Concrete
214R-02 ..... Evaluation of Strength Test Results of Concrete
301-10 ..... Structural Concrete
304R-00(R2009) ..... Guide for Measuring, Mixing, Transporting, and Placing Concrete
305R-10 ..... Hot Weather Concreting
306R-10 ..... Cold Weather Concreting
308R-01(R2008) ..... Standard Practice for Curing Concrete
309R-05 ..... Guide for Consolidation of Concrete
318-08 ..... Building Code Requirements for Reinforced Concrete and Commentary
347-04 ..... Guide to Formwork for Concrete
SP-66-04 ..... ACI Detailing Manual

C. American National Standards Institute and American Hardboard Association (ANSI/AHA):

A135.4-2004.....Basic Hardboard

D. American Society for Testing and Materials (ASTM):

A82/A82M-07 .....Steel Wire, Plain, for Concrete Reinforcement

A185/185M-07.....Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

A615/A615M-09 .....Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

A653/A653M-09 .....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

A706/A706M-09 .....Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

A767/A767M-09 .....Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

A775/A775M-07 .....Epoxy-Coated Reinforcing Steel Bars

A820-06.....Steel Fibers for Fiber-Reinforced Concrete

A996/A996M-09 .....Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

C31/C31M-09.....Making and Curing Concrete Test Specimens in the field

C33-08 .....Concrete Aggregates

C39/C39M-09.....Compressive Strength of Cylindrical Concrete Specimens

C94/C94M-09.....Ready-Mixed Concrete

C143/C143M-10.....Slump of Hydraulic Cement Concrete

C150-09 .....Portland Cement

C171-07 .....Sheet Materials for Curing Concrete

C172-08 .....Sampling Freshly Mixed Concrete

C173-10... .....Air Content of Freshly Mixed Concrete by the Volumetric Method

C192/C192M-07.....Making and Curing Concrete Test Specimens in the Laboratory

C231-09 .....Air Content of Freshly Mixed Concrete by the Pressure Method

C260-06 .....Air-Entraining Admixtures for Concrete

C309-07 .....Liquid Membrane-Forming Compounds for Curing Concrete

C330-09 .....Lightweight Aggregates for Structural Concrete

C494/C494M-10.....Chemical Admixtures for Concrete

C618-08 .....Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

C666/C666M-03.....Resistance of Concrete to Rapid Freezing and Thawing

C881/C881M-02.....Epoxy-Resin-Base Bonding Systems for Concrete

C1107/1107M-08 .....Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

C1315-08 .....Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
D6-95(R2006) .....Loss on Heating of Oil and Asphaltic Compounds
D297-93(R2006) .....Rubber Products-Chemical Analysis
D1751-04(R2008) .....Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
D4397-09 .....Polyethylene Sheeting for Construction, Industrial and Agricultural Applications
E1155-96(R2008) .....Determining $F_F$ Floor Flatness and $F_L$ Floor Levelness Numbers

E. American Welding Society (AWS):
D1.4/D1.4M-11.....Structural Welding Code - Reinforcing Steel

F. Concrete Reinforcing Steel Institute (CRSI):
Handbook 2008

G. National Cooperative Highway Research Program (NCHRP):
Report On.....Concrete Sealers for the Protection of Bridge Structures

H. U. S. Department of Commerce Product Standard (PS):
PS 1.....Construction and Industrial Plywood
PS 20.....American Softwood Lumber

I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:
CRD C513.....Rubber Waterstops
CRD C572.....Polyvinyl Chloride Waterstops

**PART 2 – PRODUCTS:**

**2.1 FORMS:**

A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.

B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.

C. Metal for Concrete Rib-Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.

D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.

E. Corrugated Fiberboard Void Boxes: Double faced, completely impregnated with paraffin and laminated with moisture resistant adhesive, size as shown. Design forms to support not less than 48 KPa (1000 psf) and not lose more than 15 percent of their original strength after being completely submerged in water for 24 hours and then air dried.

F. Form Lining:

1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.

G. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

**2.2 MATERIALS:**

A. Portland Cement: ASTM C150 Type I or II.

B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition (LOI) not to exceed 5 percent.

C. Coarse Aggregate: ASTM C33.
1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.

D. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.

E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150 µm (No. 100) sieve.

F. Mixing Water: Fresh, clean, and potable.

G. Admixtures:
1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must

have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.

5. Air Entraining Admixture: ASTM C260.
6. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
7. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.

H. Vapor Barrier: ASTM D4397, 0.25 mm (10 mil).

I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.

J. Welded Wire Fabric: ASTM A185.

K. Reinforcing Bars to be Welded: ASTM A706.

L. Galvanized Reinforcing Bars: ASTM A767.

M. Epoxy Coated Reinforcing Bars: ASTM A775.

N. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/$m^2$ (1.5 pounds per square yard), or square mesh at .6Kg/$m^2$ (1.17 pounds per square yard).

P. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.

Q. Expansion Joint Filler: ASTM D1751.

R. Sheet Materials for Curing Concrete: ASTM C171.

S. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.

T. Moisture Vapor Emissions & Alkalinity Control Sealer: 100% active colorless aqueous siliconate solution concrete surface treatment applied the day of the concrete pour in lieu of other curing methods for all concrete slabs receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays .

1. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34% solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product shall have at least a five (5) year documented history in controlling moisture vapor emission from damaging floor covering, compatible with all finish materials.
2. MVE 15-Year Warranty:
   a. When a floor covering is installed on a below grade, on grade, or above grade concrete slab treated with Moisture Vapor Emissions & Alkalinity Control Sealer according to manufacturer’s instruction, sealer manufacturer shall warrant the floor covering system against failure due to moisture vapor migration or moisture-born contaminates for a

period of fifteen (15) years from the date of original installation. The warranty shall cover all labor and materials needed to replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.

U. Penetrating Sealer: For use on parking garage ramps and decks. High penetration silane sealer providing minimum 95 percent screening per National Cooperative Highway Research Program (NCHRP) No. 244 standards for chloride ion penetration resistance. Requires moist (non-membrane) curing of slab.

V. Non-Shrink Grout:

1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (5000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.
2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

**2.3 CONCRETE MIXES:**

A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.

1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, fly ash, admixtures, weight of fine and coarse aggregate per $m^3$ (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement-fly ash ratio, and consistency of each cylinder in terms of slump.
3. Prepare a curve showing relationship between water-cement-fly ash ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
4. If the field experience method is used, submit complete standard deviation analysis.

B. Fly Ash Testing: Submit certificate verifying conformance with specifications initially with mix design and for each truck load of fly ash delivered from source. Notify Project Engineer immediately when change in source is anticipated. Prior to beginning trial mixes submit to the Project Engineer the following representative samples of material to be used, properly identified source and project description and number, type of testing (complete chemical and physical), suitably packaged for shipment, and addressed as specified. Allow 60 calendar days for test results after submittal of sample.

1. Fly ash - 2.25 kg (five pounds).

2. Portland cement - 3.5 kg (8 pounds):
   a. Address -Waterways Experiment Station (WES)
   b. 3909 Halls Ferry Road
   c. Vicksburg, MS 39180-6199
   d. ATTN: Engineering Materials Group

C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Project Engineer or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement and fly ash, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Project Engineer may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and fly ash and approval of design mix.

D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with 20% replacement by weight in all structural work. Increase this replacement to 40% for mass concrete, and reduce it to 10% for drilled piers and caissons.

**TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE**

| Concrete Strength | | Non-Air-Entrained | Air-Entrained | |
|---|---|---|---|---|
| Min. 28 Day Comp. Str. MPa (psi) | Min. Cement $kg/m^3$ (lbs/c. yd) | Max. Water Cement Ratio | Min. Cement $kg/m^3$ (lbs/c. yd) | Max. Water Cement Ratio |
| 35 (5000)[1,3] | 375 (630) | 0.45 | 385 (650) | 0.40 |
| 30 (4000)[1,3] | 325 (550) | 0.55 | 340 (570) | 0.50 |
| 25 (3000)[1,3] | 280 (470) | 0.65 | 290 (490) | 0.55 |
| 25 (3000)[1,2] | 300 (500) | * | 310 (520) | * |

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
4. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

**TABLE II - MAXIMUM SLUMP, MM (INCHES)***

| Type of Construction | Normal Weight Concrete | Lightweight Structural Concrete |
|---|---|---|
| Reinforced Footings and Substructure Walls | 75mm (3 inches) | 75 mm (3 inches) |
| Slabs, Beams, Reinforced Walls, and Building Columns | 100 mm (4 inches) | 100 mm (4 inches) |

F. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches), and 75 mm to 100 mm (3 inches to 4 inches) for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

G. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural concrete shall conform with Table IV. Determine air content by either ASTM C173 or ASTM C231.

**TABLE III - TOTAL AIR CONTENT**
**FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

| Nominal Maximum Size of Total Air Content | Coarse Aggregate, mm (Inches) Percentage by Volume |
|---|---|
| 10 mm (3/8 in).6 to 10 | 13 mm (1/2 in).5 to 9 |
| 20 mm (3/4 in).4 to 8 | 25 mm (1 in).3-1/2 to 6-1/2 |
| 40 mm (1 1/2 in).3 to 6 | |

**TABLE IV**
**AIR CONTENT OF LIGHTWEIGHT STRUCTURAL CONCRETE**

| Nominal Maximum size of Total Air Content | Coarse Aggregate, mm's (Inches) Percentage by Volume |
|---|---|
| Greater than 10 mm (3/8 in) 4 to 8 | 10 mm (3/8 in) or less 5 to 9 |

H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.

I. Lightweight structural concrete shall not weigh more than air-dry unit weight shown. Air-dry unit weight determined on 150 mm by 300 mm (6 inch by 12 inch) test cylinders after seven days standard moist curing followed by 21 days drying at 23 degrees C $\pm$ 1.7 degrees C (73.4 $\pm$ 3 degrees Fahrenheit), and 50 (plus or minus 7) percent relative humidity. Use wet unit weight of fresh concrete as basis of control in field.

J. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

K. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. Air content as shown in Table III or Table IV.

L. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Project Engineer may require any one or any combination of the following corrective actions, at no additional cost to the Government:

1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
2. Require additional curing and protection.
3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, Project Engineer may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, Project Engineer may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Project Engineer.

**2.4 BATCHING AND MIXING:**

A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by Project Engineer. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is $38^0$C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

| Atmospheric Temperature | Minimum Concrete Temperature |
|---|---|

| | |
|---|---|
| -1. degrees to 4.4 degrees C (30 degrees to 40 degrees F) | 15.6 degrees C (60 degrees F.) |
| -17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.) | 21 degrees C (70 degrees F.) |

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the Project Engineer for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise Project Engineer.

**PART 3 – EXECUTION**

**3.1 FORMWORK:**

A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
   1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and Project Engineer approves their reuse.
   2. Provide forms for concrete footings unless Project Engineer determines forms are not necessary.
   3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.

B. Treating and Wetting: Treat or wet contact forms as follows:
   1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
   2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
   3. Use sealer on reused plywood forms as specified for new material.

C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than 1/270 of free span of member.

D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.

E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent

bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.

F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.

G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.

1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.

H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.

1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
3. Do not install sleeves in beams, joists or columns except where shown or permitted by Project Engineer. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the Project Engineer, and require no structural changes, at no additional cost to the Government.
4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

I. Construction Tolerances:

1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

**3.2 PLACING REINFORCEMENT:**

A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.

B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
   1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Use epoxy-coated tie wire with epoxy-coated reinforcing. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Use of brick or stone supports will not be permitted.
   2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
   3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.

C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.

D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
   1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
   2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength (fy) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
      a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.

b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.

3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength (fy) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.

E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by Project Engineer.

F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.

G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

**3.3 VAPOR BARRIER:**

A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.

1. Place 100 mm (4 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
2. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure-sensitive tape.
3. Patch punctures and tears.

**3.4 MOISTURE VAPOR EMISSIONS & ALKALINITY CONTROL SEALER:**

A. Sealer is applied on the day of the concrete pour or as as soon as harsh weather permits, prior to any other chemical treatments for concrete slabs either on grade, below grade or above grade receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays.

B. Manufacturer's representative will be on the site the day of concrete pour to install or train its application and document. He shall return on every application thereafter to verify that proper procedures are followed.

1. Apply Sealer to concrete slabs as soon as final finishing operations are complete and the concrete has hardened sufficiently to sustain floor traffic without damage.
2. Spray apply Sealer at the rate of 20 $m^2$ (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
3. If within two (2) hours after initial application areas are subjected to heavy rainfall and puddling occurs, reapply sealer product to these areas as soon as weather condition permits.

**3.5 CONSTRUCTION JOINTS:**

A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by Project Engineer.

B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.

C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.

D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.

**3.6 EXPANSION JOINTS:**

A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

**3.7 PLACING CONCRETE:**

A. Preparation:

1. Remove hardened concrete, wood chips, shavings and other debris from forms.
2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
3. Have forms and reinforcement inspected and approved by Project Engineer before depositing concrete.
4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.

B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.

1. Preparing surface for applied topping:
   a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
   b. Broom clean and keep base slab wet for at least four hours before topping is applied.
   c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of Project Engineer.

D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.

1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
6. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
7. Concrete on metal deck:
    a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.
        1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.

E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.

1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

**3.8 HOT WEATHER:**

Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Project Engineer.

**3.9 COLD WEATHER:**

Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyantes or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Project Engineer.

**3.10 PROTECTION AND CURING:**

A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by Project Engineer.

1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10$m^2$/L (400 square feet per gallon) on steel troweled surfaces and 7.5$m^2$/L (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

**3.11 REMOVAL OF FORMS:**

A. Remove in a manner to assure complete safety of structure after the following conditions have been met.

1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.

B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. //For post-tensioned systems supporting forms and shoring not removed until stressing is completed. //Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

C. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading. //In addition, for flat slab/plate, reshoring is required immediately after stripping operations are complete and not later than the end of the same day. //Reshoring accomplished in accordance with ACI 347 at no additional cost to the Government.

**3.12 CONCRETE SURFACE PREPARATION:**

A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.

B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches) surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.

C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

**3.13 CONCRETE FINISHES:**

A. Vertical and Overhead Surface Finishes:

1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other unfinished areas will not require additional finishing.
2. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by Project Engineer, and by rubbing lightly with a fine abrasive stone or hone. Use ample water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
   a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
   b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600 µm (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
   c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
   d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.
4. Textured: Finish as specified. Maximum quantity of patched area 0.2 $m^2$ (2 square feet) in each 93 $m^2$ (1000 square feet) of textured surface.

B. Slab Finishes:

1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to Project Engineer and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless Project

Engineer determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.

3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and

exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.

10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by Project Engineer from sample panel.
11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
    a. Areas covered with carpeting, or not specified otherwise in b. below:
        1) Slab on Grade:
            a) Specified overall value $F_F$ 25/$F_L$ 20
            b) Minimum local value $F_F$ 17/$F_L$ 15
        2) Level suspended slabs (shored until after testing) and topping slabs:
            a) Specified overall value FF 25/FL 20
            b) Minimum local value FF 17/FL 15
        3) Unshored suspended slabs:
            a) Specified overall value FF 25
            b) Minimum local value FF 17
        4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
    b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:
        1) Slab on grade:
            a) Specified overall value FF 36/FL 20
            b) Minimum local value FF 24/FL 15
        2) Level suspended slabs (shored until after testing) and topping slabs
            a) Specified overall value FF 30/FL 20
            b) Minimum local value FF 24/FL 15
        3) Unshored suspended slabs:
            a) Specified overall value FF 30
            b) Minimum local value FF 24
        4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
    c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.
    d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a

construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.

12. Measurements
    a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by Project Engineer, to verify compliance with FF, FL, and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs retained testing laboratory.
    b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.
13. Acceptance/ Rejection:
    a. If individual slab section measures less than either of specified minimum local $F_F/F_L$ numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
    b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall $F_F/F_L$ numbers, then whole slab shall be rejected and remedial measures shall be required.
14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by Project Engineer, until a slab finish constructed within specified tolerances is accepted.

**3.14 SURFACE TREATMENTS:**

A. Use on exposed concrete floors and concrete floors to receive carpeting // except those specified to receive non-slip finish.

B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.

C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs. Broadcast aggregate uniformly over concrete surface at rate of application of 8% per 1/10th $m^2$ (7.5 percent per square

foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

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**SECTION 04 05 13**
**MASONRY MORTARING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Section specifies mortar materials and mixes.

**1.2 RELATED WORK:**

A. Mortar used in Section:
   1. Section 04 20 00, UNIT MASONRY.
B. Mortar Color: To match adjacent existing mortar joints.

**1.3 SUBMITTALS**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Certificates:
   1. Indicating that following items meet specifications:
      a. Portland cement.
      b. Masonry cement.
      c. Mortar cement.
      d. Hydrated lime.
      e. Fine aggregate (sand).
C. Laboratory Test Reports:
   1. Mortar, each type.
   2. Admixtures.
D. Manufacturer's Literature and Data:
   1. Cement, each kind.
   2. Hydrated lime.
   3. Admixtures.
   4. Liquid acrylic resin.

**1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

**1.5 APPLICABLE PUBLICATIONS**

A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
B. American Society for Testing and Materials (ASTM):
   C40-04 .....Organic Impurities in Fine Aggregates for Concrete

C91-05 .....Masonry Cement
C109-08 .....Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-MM Cube Specimens)
C144-04 .....Aggregate for Masonry Mortar
C150-09 .....Portland Cement
C207-06 .....Hydrated Lime for Masonry Purposes
C270-10 .....Mortar for Unit Masonry
C307-03(R2008) .....Tensile Strength of Chemical - Resistant Mortar, Grouts, and Monolithic Surfacing
C321-00(R2005) .....Bond Strength of Chemical-Resistant Mortars
C348-08 .....Flexural Strength of Hydraulic Cement Mortars
C595-10 .....Blended Hydraulic Cement
C780-10 .....Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1329-05 .....Mortar Cement

**PART 2 - PRODUCTS**

**2.1 HYDRATED LIME**

ASTM C207, Type S.

**2.2 AGGREGATE FOR MASONRY MORTAR**

A. ASTM C144 and as follows:
   1. Light colored sand for mortar for laying face brick.
B. Test sand for color value in accordance with ASTM C40. Sand producing color darker than specified standard is unacceptable.

**2.3 MASONRY CEMENT**

A. ASTM C91. Type N.

**2.4 MORTAR CEMEMT**

ASTM C1329, Type N.

**2.5 PORTLAND CEMENT**

A. ASTM C150, Type N.

**2.6 LIQUID ACRYLIC RESIN**

A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.

**2.7 WATER**

Potable, free of substances that are detrimental to mortar, masonry, and metal.

**2.8 MASONRY MORTAR**

A. Conform to ASTM C270.
B. Admixtures:

1. Do not use mortar admixtures unless approved by Resident Engineer.
2. Submit laboratory test report showing effect of proposed admixture on strength, water retention, and water repellency of mortar.
3. Do not use antifreeze compounds.

**PART 3 - EXECUTION**

**3.1 MIXING**

A. Mix in a mechanically operated mortar mixer. Mix mortar for at least three minutes but not more than five minutes.

B. Measure ingredients by volume. Measure by the use of a container of known capacity.

C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.

D. Mortar that has stiffened because of loss of water through evaporations:
   1. Re-tempered by adding water to restore to proper consistency and workability.
   2. Discard mortar that has reached its initial set or has not been used within two hours.

E. Pointing Mortar:
   1. Mix dry ingredients with enough water to produce a damp mixture of workable consistency which will retain its shape when formed into a ball.
   2. Allow mortar to stand in dampened condition for one to 1-1/2 hours.
   3. Add water to bring mortar to a workable consistency prior to application.

**3.2 MORTAR USE LOCATION**

A. For brick veneer over frame back up walls, use Type N portland cement-lime mortar.

B. Use Type N mortar for other masonry work, except as otherwise specified.

C. Use Type N mortar for tuck pointing work.

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**SECTION 04 05 31**
**MASONRY TUCK POINTING**

## PART 1 - GENERAL

### 1.1 DESCRIPTION

This section specifies requirements for tuck pointing of existing masonry parapet walls and parapet wall stone caps. And waterproof sealing of masonry units.

### 1.2 RELATED WORK

Mortars: Section 04 05 13, MASONRY MORTARING.

### 1.3 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Society for Testing and Materials (ASTM):
C67-07 .....Brick and Structural Clay Tile, Sampling and Testing
C216-07 .....Facing Brick (Solid Masonry Units Made From Clay or Shale)
C270-07 .....Mortar for Unit Masonry

C. International Masonry Institute: Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

## PART 2 - PRODUCTS

### 2.1 TUCK POINTING MORTAR

As per appendix X3 of ASTM C270.

### 2.2 REPLACEMENT MASONRY UNITS

A. Face Brick:
1. ASTM C216, Grade SW, Type FBS. Brick shall be classified slightly efflorescent or better when tested in accordance with ASTM C67.
2. Face brick shall match facing brick of the existing building that is being tuck pointed.

## PART 3 - EXECUTION

### 3.1 CUT OUT OF EXISTING MORTAR JOINTS

A. Cut out existing mortar joints (both bed and head joints) and remove by means of a toothing chisel or a special pointer's grinder, to a uniform depth of to 19 mm (3/4-inch), or until sound mortar is reached. Take care to not damage edges of existing masonry units to remain.

B. Remove dust and debris from the joints by brushing, blowing with air or rinsing with water. Do not rinse when temperature is below freezing.

### 3.2 JOB CONDITIONS

A. Protection: Protect newly pointed joints from rain, until pointed joints are sufficiently hard enough to prevent damage.

B. Cold Weather Protection:
1. Tuck pointing may be performed in freezing weather when methods of protection are utilized.

2. Comply with applicable sections of "Recommended Practices for Cold Weather Construction" as published by International Masonry Industry All Weather Council.
3. Existing surfaces at temperatures to prevent mortar from freezing or causing other damage to mortar.

**3.3 INSTALLATION OF TUCK POINTING MORTAR**

A. Immediately prior to application of mortar, dampen joints to be tuck pointed. Prior to application of pointing mortar, allow masonry units to absorb surface water.
B. Tightly pack mortar into joints in thin layers, approximately 6 mm (1/4-inch) thick maximum.
C. Allow layer to become "thumbprint hard" before applying next layer.
D. Pack final layer flush with surfaces of masonry units. When mortar becomes "thumbprint hard", tool joints.

**3.4 TOOLING OF JOINTS**

A. Tool joints with a jointing tool to produce a smooth, compacted, concaved joint.
B. Tool joints in patch work with a jointing tool to match the existing surrounding joints.

**3.5 REPLACEMENT OF MASONRY UNITS**

A. Cut out mortar joints surrounding masonry units that are to be removed and replaced.
   1. Units removed may be broken and removed, providing surrounding units to remain are not damaged.
   2. Once the units are removed, carefully chisel out the old mortar and remove dust and debris.
   3. If units are located in exterior wythe of a cavity or veneer wall, exercise care to prevent debris falling into cavity.
   **4. Include replacement of 25 brick masonry units in project bid.**
B. Dampen surfaces of the surrounding units before new units are placed.
   1. Allow existing masonry to absorb surface moisture prior to starting installation of the new replacement units.
   2. Butter contact surfaces of existing masonry and new replacement masonry units with mortar.
   3. Center replacement masonry units in opening and press into position.
   4. Remove excess mortar with a trowel.
   5. Point around replacement masonry units to ensure full head and bed joints.
   6. When mortar becomes "thumbprint hard", tool joints.

**3.6 CLEANING AND SEALING**

A. Clean exposed masonry surfaces on completion.
B. Remove mortar droppings and other foreign substances from wall surfaces.
C. First wet surfaces with clean water, then wash down with a solution of soapless detergent specially prepared for cleaning brick.
D. Brush with stiff fiber brushes while washing, and immediately thereafter hose down with clean water.

E. Free clean surfaces from traces of detergent, foreign streaks or stains. Protect materials during cleaning operations including adjoining construction.

F. Apply clear masonry waterproofing to parapet walls and stone caps following manufacture's printed instructions.

F. Use of muratic acid for cleaning is prohibited.

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**SECTION 04 20 00**
**UNIT MASONRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies requirements for construction of masonry unit walls.

**1.2 RELATED WORK**

A. Mortars: Section 04 05 13, MASONRY MORTARING.

B. Tuck Pointing: Section 04 05 31, MASONRY TUCK POINTING.

C. Masonry Sealing: Section 07 19 23, WATER REPELLANTS.

**1.3 SUBMITTALS**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Samples:

1. Face brick.

c. Certificates:

1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
2. Indicating that the following items meet specification requirements:
   a. Face brick.

**1.4 WARRANTY**

Warrant exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction" article in Section GENERAL CONDITIONS.

**1.5 APPLICABLE PUBLICATIONS**

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

C62-05 .....Building Brick (Solid Masonry Units Made From Clay or Shale)
C67-07 .....Sampling and Testing Brick and Structural Clay Tile
C216-07 .....Facing Brick (Solid Masonry Units Made From Clay or Shale)
C476-02 .....Standard Specification for Grout for Masonry

C. Masonry Industry Council:

All Weather Masonry Construction Manual, 2000.

d. Brick Industry Association - Technical Notes on Brick Construction (BIA):

11-1986 .....Guide Specifications for Brick Masonry, Part I
11A–1988.....Guide Specifications for Brick Masonry, Part II
11B–1988.....Guide Specifications for Brick Masonry, Part III Execution

11C-1998 .....Guide Specification for Brick Masonry Engineered Brick Masonry, Part IV

11D-1988 .....Guide Specifications for Brick Masonry Engineered Brick Masonry, Part IV continued

G. Masonry Standards Joint Committee; Specifications for Masonry Structures (ACI 530.1-05/ASCE 6-05/TMS 602-99) (MSJC).

**PART 2 - PRODUCTS**

**2.1 BRICK**

A. Face Brick:
   1. ASTM C216, Grade SW, Type FBS.
   2. Brick when tested in accordance with ASTM C67: Classified slightly efflorescent or better.
   3. Size: Modular, to match existing.

**2.2 ACCESSORIES**

A. Masonry Cleaner:
   1. Detergent type cleaner selected for each type masonry used.
   2. Acid cleaners are not acceptable.
   3. Use soapless type specially prepared for cleaning brick.

**PART 3 - EXECUTION**

**3.1 JOB CONDITIONS**

A. Protection:
   1. Cover tops of walls with nonstaining waterproof covering, when work is not in progress. Secure to prevent wind blow off.

B. Cold Weather Protection:
   1. Masonry may be laid in freezing weather when methods of protection are utilized.
   2. Comply with MSJC and “Hot and Cold Weather Masonry Construction Manual”.

**3.2 CONSTRUCTION TOLERANCES**

A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:

B. Maximum variation from plumb:
   1. In 3000 mm (10 feet) - 6 mm (1/4 inch).

C. Maximum variation from level:
   1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).

D. Maximum variation from linear building lines:
   1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).

**3.3 INSTALLATION GENERAL**

A. Keep finish work free from mortar smears or spatters, and leave neat and clean.

B. Tooling Joints:

1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
2. Tool while mortar is soft enough to be compressed into joints and not raked out.
3. Finish joints in face brick work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.

C. Wetting and Wetting Test:
1. Test and wet brick or clay tile in accordance with BIA 11B.

**3.4 BRICK EXPANSION AND CMU CONTROL JOINTS.**

A. Where joints occur in masonry walls.
1. Install preformed compressible joint filler in brick wythe.
2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on each side of shear key.
3. Install filler, backer rod, and sealant on exposed faces.

B. Keep joint free of mortar and other debris.

C. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

**3.5 BRICKWORK**

A. Lay clay brick in accordance with BIA Technical Note 11 series.

B. Laying:
1. Maintain existing pattern throughout.
2. Do not use brick smaller than half-brick at any angle, corner, break or jamb.
3. Where length of cut brick is greater than one half but less than a whole brick, maintain the vertical joint location of such units.

**3.6 CLEANING AND REPAIR**

A. General:
1. Clean exposed masonry surfaces on completion.
2. Protect adjoining construction materials and landscaping during cleaning operations.
3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
4. Remove mortar droppings and other foreign substances from wall surfaces.

B. Brickwork:
1. First wet surfaces with clean water, then wash down with a solution of soapless detergent. Do not use muriatic acid.
2. Brush with stiff fiber brushes while washing, and immediately thereafter hose down with clean water.
3. Free clean surfaces of traces of detergent, foreign streaks, or stains of any nature.

**- - - E N D - - -**

**SECTION 06 10 00**
**ROUGH CARPENTRY**

## PART 1 - GENERAL

### 1.1 DESCRIPTION:

Section specifies wood blocking, framing, sheathing, furring, nailers, rough hardware, and light wood construction.

### 1.2 RELATED WORK:

A. Roofing: Sections 07 31 13, ASPHALT SHINGLES; 07 32 13, CLAY ROOF TILES; 07 53 23, ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING.

B. Flashing: 07 60 00 FLASHING AND SHEETMETAL.

### 1.3 SUMBITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect lumber and other products from dampness both during and after delivery at site.

B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

C. Stack plywood and other board products so as to prevent warping.

D. Locate stacks on well drained areas, supported at least 150 mm (6 inches) above grade and cover with well ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

### 1.5 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Forest and Paper Association (AFPA):

National Design Specification for Wood Construction

| | |
|---|---|
| NDS-05 | Conventional Wood Frame Construction |

C. American Institute of Timber Construction (AITC):

| | |
|---|---|
| A190.1-02 | Structural Glued Laminated Timber |

D. American Society of Mechanical Engineers (ASME):

| | |
|---|---|
| B18.2.1A-96(R2005) | Square and Hex Bolts and Screws |
| B18.2.2-87(R2005) | Square and Hex Nuts |
| B18.6.1-81 (R97) | Wood Screws |
| B18.6.4-98(R2005) | Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws |

E. American Plywood Association (APA):

| | |
|---|---|
| E30-03 | Engineered Wood Construction Guide |

F. American Society for Testing And Materials (ASTM):

| | |
|---|---|
| A47-99(R2004) | Ferritic Malleable Iron Castings |
| A48-03 | Gray Iron Castings |
| A653/A653M-07 | Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process |
| C954-04 | Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness |
| D143-94(R2004) | Small Clear Specimens of Timber, Method of Testing |
| D1760-01 | Pressure Treatment of Timber Products |
| D2559-04 | Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions |
| D3498-03 | Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems |
| F844-07 | Washers, Steel, Plan (Flat) Unhardened for General Use |
| F1667-05 | Nails, Spikes, and Staples |

G. Federal Specifications (Fed. Spec.):

| | |
|---|---|
| MM-L-736C | Lumber; Hardwood |

H. Commercial Item Description (CID):

| | |
|---|---|
| A-A-55615 | Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors) |

I. Military Specification (Mil. Spec.):

| | |
|---|---|
| MIL-L-19140E | Lumber and Plywood, Fire-Retardant Treated |

J. Truss Plate Institute (TPI):

| | |
|---|---|
| TPI-85 | Metal Plate Connected Wood Trusses |

K. U.S. Department of Commerce Product Standard (PS)

| | |
|---|---|
| PS 1-95 | Construction and Industrial Plywood |
| PS 20-05 | American Softwood Lumber Standard |

**PART 2 - PRODUCTS**

**2.1 LUMBER:**

A. Unless otherwise specified, each piece of lumber bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.

1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Structural Members: Species and grade as listed in the AFPA, National Design Specification for Wood Construction having design stresses as shown.

C. Lumber Other Than Structural:
1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
2. Framing lumber: Minimum extreme fiber stress in bending of 1100.
3. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.

D. Sizes:
1. Conforming to Prod. Std., PS20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:
1. At time of delivery and maintained at the site.
2. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
3. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:
1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:
1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 600 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members used in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with ASTM D1760, except any process involving the use of Chromated Copper arsenate (CCA) for pressure treating wood is not permitted.

**2.2 PLYWOOD**

A. Comply with Prod. Std., PS 1.

B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.

C. Sheathing:

1. APA rated Exposure 1 or Exterior; panel grade CD or better.
2. Wall sheathing:
    a. Minimum 12 mm (15/32 inch) thick.
    b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
3. Roof sheathing:
    a. Minimum 12 mm (15/32 inch) thick

**2.4 ROUGH HARDWARE AND ADHESIVES:**

A. Anchor Bolts:

1. ASME B18.2.1 and ANSI B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
2. Extend at least 200 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).

B. Miscellaneous Bolts: Expansion Bolts: C1D, A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Use 13 mm (1/2 inch) bolt unless shown otherwise.

C. Washers

1. ASTM F844.
2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.

D. Screws:

1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:

1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
2. ASTM F1667:
    a. Common: Type I, Style 10.
    b. Concrete: Type I, Style 11.
    c. Barbed: Type I, Style 26.
    d. Underlayment: Type I, Style 25.
    e. Masonry: Type I, Style 27.
    f. Use special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

F. Framing and Timber Connectors:

1. Fabricate of ASTM A446, Grade A; steel sheet not less than 1.3 mm (0.052 inch) thick unless specified otherwise. Apply standard plating to steel timber connectors after punching, forming and assembly of parts.
2. Framing Angles: Angle designed with bendable legs to provide three way anchors.
3. Straps:
   a. Designed to provide wind and seismic ties with sizes as shown or specified.
   b. Strap ties not less than 32 mm (1-1/4 inches) wide.
   c. Punched for fastener.
4. Metal Bridging:
   a. Optional to wood bridging.
   b. V shape deformed strap with not less than 2 nail holes at ends, designed to nail to top and side of framing member and bottom and side of opposite member.
   c. Not less than 19 mm by 125 mm (3/4 by 5 inches) bendable nailing flange on ends.
   d. Fabricated of 1 mm (0.04 inch) minimum thick sheet.
5. Joist Hangers:
   a. Fabricated of 1.6 mm (0.063 inch) minimum thick sheet, U design unless shown otherwise.
   b. Heavy duty hangers fabricated of minimum 2.7 mm (0.108 inch) thick sheet, U design with bent top flange to lap over beam.
6. Timber Connectors: Fabricated of steel to shapes shown.
7. Joist Ties: Mild steel flats, 5 by 32 mm (3/16 by 1-1/4 inch size with ends bent about 30 degrees from horizontal, and extending at least 400 mm (16 inches) onto framing. Punch each end for three spikes.
8. Wall Anchors for Joists and Rafters:
   a. Mild steel strap, 5 by 32 mm (3/16 by 1-1/4 inch) with wall ends bent 50 mm (2 inches), or provide 9 by 130 mm (3/8 by 5 inch) pin through strap end built into masonry.
   b. Strap long enough to extend onto three joists or rafters, and punched for spiking at each bearing.
   c. Strap not less than 100 mm (4 inches) embedded end.
9. Joint Plates:
   a. Steel plate punched for nails.
   b. Steel plates formed with teeth or prongs for mechanically clamping plates to wood.
   c. Size for axial eccentricity, and fastener loads.

G. Adhesives:

1. For field-gluing plywood to lumber framing roof systems: ASTM D3498.
2. For structural laminated Wood: ASTM D2559.

**PART 3 - EXECUTION**

**3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:**

A. Conform to applicable requirements of the following:

1. AFPA National Design Specification for Wood Construction for timber connectors.
2. AITC Timber Construction Manual for heavy timber construction.
3. AFPA WCD-number 1, Manual for House Framing for nailing and framing unless specified otherwise.
4. APA for installation of plywood or structural use panels.
5. TPI for metal plate connected wood trusses.

B. Fasteners:

1. Nails.

a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA Manual for House Framing where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.

b. Use special nails with framing connectors.

c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.

d. Use eight penny or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.

e. Use 16 penny or larger nails for nailing through 50 mm (2 inch) thick lumber.

f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.

g. Nailing Schedule; Using Common Nails:

1) Joist bearing on sill or girder, toe nail three-8d or framing anchor
2) Bridging to joist, toe nail each end two-8d.
3) Ledger strip to beam or girder three-16d under each joint.
4) Subflooring or Sheathing:

a) 150 mm (6 inch) wide or less to each joist face nail two-8d.

b) Subflooring, more than 150 mm (6 inches) wide, to each stud or joint, face nail three-8d.

c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 150 mm (6 inches) on center and at intermediate supports 250 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 300 mm (12 inches) at supported edges and 500 mm (20 inches) o.c. at intermediate supports.

5) Sole plate to joist or blocking, through sub floor face nail 20d nails, 400 mm (16 inches) on center.

6) Top plate to stud, end nail two-16d.

7) Stud to sole plate, toe nail or framing anchor. Four-8d.

8) Doubled studs, face nail 16d at 600 mm (24 inches) on center.

9) Built-up corner studs 16d at 600 mm (24 inches) (24 inches) on center.

10) Doubled top plates, face nails 16d at 400 mm (16 inches) on center.

11) Top plates, laps, and intersections, face nail two-16d.

12) Continuous header, two pieces 16d at 400 mm (16 inches) on center along each edge.

13) Continuous header to stud, four 16d.

14) Rafter to plate, toe nail three-8d. or framing anchor. Brace 25 mm (1 inch) thick board to each stud and plate, face nail three-8d.

2. Bolts:

a. Fit bolt heads and nuts bearing on wood with washers.

b. Countersink bolt heads flush with the surface of nailers.

c. Embed in concrete and solid masonry or use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.

d. Use toggle bolts to hollow masonry or sheet metal.

e. Use bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 600 mm (24 inch) intervals between end bolts. Use clips to beam flanges.

3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.

a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.

b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.

4. Power actuated drive pins may be used where practical to anchor to solid masonry, concrete, or steel.

5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Use metal plugs, inserts or similar fastening.

6. Screws to Join Wood:

a. Where shown or option to nails.

b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.

c. Spaced same as nails.

7. Installation of Timber Connectors:

a. Conform to applicable requirements of the NFPA National Design Specification for Wood Construction.

b. Fit wood to connectors and drill holes for fasteners so wood is not split.

C. Blocking Nailers, and Furring:

1. Install furring, blocking, nailers, and grounds where shown.

2. Use longest lengths practicable.

3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.

4. Layers of Blocking or Plates:

a. Stagger end joints between upper and lower pieces.

b. Nail at ends and not over 600 mm (24 inches) between ends.

c. Stagger nails from side to side of wood member over 125 mm (5 inches) in width.

D. Bridging:

1. Use 25 mm by 75 mm (1 inch by 3 inch) lumber with ends beveled for slope. Option: Metal bridging may be used for wood bridging.

2. Install one row of bridging for joist spans over 2400 mm (8 feet), but less than 4800 mm (16 feet) long; install two rows for spans over 4800 mm (16 feet) long.

3. Install an extra row of bridging between trimmer and next two joists if header is more than 600 mm (2 feet) from end of trimmer or from regular row of bridging.

4. Secure with two nails at ends.

5. Leave bottom ends loose until after subflooring or roof sheathing is installed.

6. Install single row of bridging at centerline of span and two rows at the third points of span unless otherwise shown.

E. Framing of Dormers:

1. Frame as shown, with top edge of ridge beveled to pitch of roof header.

2. Set studs on doubled trimmer rafters.

3. Double studs at corners of dormers.

4. Double plate on studs and notch rafters over plate and bear at least 75 mm (3 inches) on plates.

5. Frame opening to receive window frame or louver frame.

F. Sheathing:

1. Use plywood or structural-use panels for sheathing.

2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.

3. Set nails not less than 9 mm (3/8 inch) from edges.

4. Install 50 mm by 100 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.

5. Match and align sheathing which is an extension of work in place to existing.

**- - - E N D - - -**

**SECTION 07 19 23**

**WATER REPELLENTS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Water-based silane/siloxane water-repellent sealer for brick wall masonry.

B. Related Sections:
   1. Section 04 05 31 – Masonry Tuck Pointing
   2. Section 04 21 00 – Unit Masonry.

### 1.2 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Submit manufacturer's technical data sheets on each product

C. Quality Control Submittals:
   1. Provide protection plan of surrounding areas and non-work surfaces.

### 1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer Qualifications: Company with minimum 15 years of experience in manufacturing of specified products.
   2. Manufacturer Qualifications: Company shall be ISO 9001:2000 Certified.
   3. Applicator Qualifications: Company with minimum of 5 years experience in application of specified products on projects of similar size and scope, and is acceptable to product manufacturer.
      a. Successful completion of a minimum of 5 projects of similar size and complexity to specified Work.

B. Field Sample:
   1. Install at pre-selected area of building an area for field sample, as directed by Architect.
      a. Conduct test on cured field sample. Allow product to fully cure 5 to 7 days before testing. Adjust application until required repellent performance is achieved.
      b. Apply material in accordance with manufacturer’s written application instructions.
   2. Field sample will be standard for judging workmanship on remainder of Project.
   3. Maintain field sample during construction for workmanship comparison.
   4. Obtain Architect’s written approval of field sample before start of material application, including approval of aesthetics, color, texture, and appearance.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer’s ordering instructions and lead-time requirements to avoid construction delays.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store in unopened containers in clean, dry area between 35 and 110 degrees F (2 and 43 degrees C).

**1.5 PROJECT CONDITIONS**

A. Environmental Requirements:

1. Minimum air, material, and surface temperature is 40 degrees F (4 degrees C).
2. Do not apply in rain or when inclement weather is expected within 12 hours. Do not apply sealer when temperatures are expected to fall below 40 degrees F (4 degrees C) within 4 hours of completed application.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

A. High-performance, water-based, VOC-compliant, clear silane/siloxane sealer used for dense, vertical masonry brick surfaces.

1. Acceptable Product: Enviroseal Double 7 for Brick by BASF Building Systems.

B. Sealer shall have the following minimum performance:

1. Flash Point, ASTM D3278: Greater than 212 degrees F (100 degrees C).
2. Leakage on Brick Wall, ASTM E514: Greater than 94.8 percent reduction.
3. Moisture-Vapor Transmission Rate, ASTM D1653, 75 degrees F (24 degrees C):
   a. 49.8 g/sf/24 hours.
   b. 86 percent of untreated substrate.
4. Accelerated Weathering, QUV, 1,500 hours: No change.
5. Solids and Active Ingredients: 12 percent by weight.
6. Specific Gravity: 1.0.
7. Density: 8.3 lbs per gal.
8. Penetration, average depth, depending upon substrate: 1/16 to 3/8 inch (1.6 to 9.5 mm).
9. VOC Content: Less than 2.09 lbs per gal (250 g/L), less water and exempt solvents.

**PART 3 - EXECUTION**

**3.1 SURFACE PREPARATION**

A. Protection: Protect plant life and surfaces to remain uncoated during application. Use drop cloths or masking as required.

B. Prepare surfaces in accordance with manufacturer’s instructions.

C. Surfaces shall be clean, dry, structurally sound, free of alkali and efflorescence. Remove dust, dirt, oil, grease, chemical films, and other contaminants.

D. Complete caulking, pointing, and restoration work before applying sealer.

**3.2 APPLICATION**

A. Apply sealer in accordance with manufacturer’s instructions.

B. Mix material thoroughly before and during application. Do not dilute.

C. Apply a mist coat of sealer immediately before application to help break surface tension, ensuring maximum penetration of sealer.

D. Flood surfaces to saturation by applying from the bottom up with controlled 8 to 10-inch (20-cm) material rundown to ensure maximum penetration into substrate.

**3.3 PROTECTION**

A. Protect sealer from damage during construction.

**END OF SECTION**

**SECTION 07 22 00**
**ROOF AND DECK INSULATION**

**1.1 DESCRIPTION**

A. Installation of roof and deck insulation, and vapor retarder on new construction ready to receive roofing or waterproof membrane.

B. Repairs and alteration work to existing roof insulation.

**1.2 RELATED WORK**

A. Wood blocking and edge strips: Section 06 10 00, ROUGH CARPENTRY.

B. Sheet metal components: Section 07 60 00, FLASHING AND SHEET METAL.

**1.3 QUALITY CONTROL**

A. Supervision of work by persons that are knowledgeable and experienced in roofing. See submittals for documentation of supervisors qualification.

B. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.

**1.4 SUBMITTALS**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Asphalt materials, each type
2. Roofing cement, each type
3. Roof insulation, each type
4. Fastening requirements
5. Insulation span data for flutes of metal decks

C. Samples:

1. Roof insulation, each type
2. Nails and fasteners, each type

D. Certificates:

1. Indicating type, thickness and thermal conductance of insulation. (Average thickness for tapered insulation).
2. Indicating materials and method of application of insulation system on metal decks meet the requirements of Factory Mutual Research Corporation for Class 1 Insulated Steel Deck Roofs.

E. Laboratory Test Reports: Thermal values of insulation products.

F. Layout of tapered roof system showing units required.

G. Documentation of supervisors training and experience showing knowledge of roofing procedures.

**1.5 DELIVERY, STORAGE AND MARKING**

A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.

B. Keep materials dry, and store in dry, weathertight facilities or under canvas tarps. Use of polyethylene or plastic tarps to cover materials is not permitted. Store above ground or deck level on wood pallets. Cover ground under stored materials with plastic tarp.

1. Store rolled materials (felts, base sheets, paper) on end. Do not store materials on top of rolled material.

2. Store foam insulation away from areas where welding is being performed and where contact with open flames is possible.

C. Protect from damage from handling, weather and construction operations before, during, and after installation.

**1.6 APPLICABLE PUBLICATIONS**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

| | |
|---|---|
| UU-B-790A..... | Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant) |

C. American Society for Testing and Materials (ASTM):

| | |
|---|---|
| C1289-06 ..... | Faced Rigid Cellular Polyisocynurate Thermal Insulation Board |
| D41-05 ..... | Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing |
| D312-00(R2006) ..... | Asphalt Used in Roofing |
| D2178-04 ..... | Asphalt Glass Felt Used in Roofing and Waterproofing |
| D2822-05 ..... | Asphalt Roof Cement |
| F1667-05..... | Driven Fasteners: Nails, Spikes, and Staples |

D. Factory Mutual Global (FM):

| | |
|---|---|
| 1-28 ..... | Winds Loads to Roof Systems and Roof Deck Securement |
| P7825-04..... | Approval Guide |

E. National Roofing Contractors Association (NRCA)

The NRCA Roofing and Waterproofing Manual - Fourth Edition.

F. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory (2003)

G. U.S. Department of Commerce (NBS):

| | |
|---|---|
| PS 1-83 ..... | Construction and Industrial Plywood |

**1.7 QUALITY ASSURANCE:**

Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance

with ASTM E 84. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM P7825. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

**PART 2 - PRODUCTS**

**2.1 ASPHALT MATERIALS**

A. Primer: ASTM D41.

B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.

C. Glass (Felt): ASTM D2178, Type IV, heavy duty ply sheet.

D. Venting Asphalt Base Sheet: ASTM D3672, Type I or Type II.

E. Roof Cement: ASTM D2822, Type I or Type II, asbestos free; or, D4586, Type I or Type II.

**2.2 INSULATION**

A. Isocyanurate Board: ASTM C1289, Type I, Class 2 or Type III.

**2.3 MISCELLANEOUS**

A. Building Paper (Sheathing Paper):

1. Fed. Spec. UU-B-790, Type I, Barrier paper, Grade D, Water - Vapor permeable, Style 1a, Uncreped, not reinforced; or, Style 1b, Uncreped, not reinforced, red rosin sized.

2. Weighing approximately 3 kg/10 $m^2$ (six pounds per 100 square feet).

**2.4 FASTENERS**

A. Nails for securing venting base sheet to insulating concrete:

1. Self-clinching type of galvanized steel having an integral flat cap at least 25 mm (one inch) across.

2. Nails shall have a holding power of not less than 27 kg (60 pounds) when pulled from 11.7 kg (25.8 pounds) density insulating concrete.

B. Fasteners for securing insulation to steel decks:

1. Conform to requirements of Factory Mutual Research Corporation for wind uplift.

2. Self-drilling galvanized screws with 50 mm (two inch) diameter disk.

3. Antibackout thread design.

4. Have a pullout resistance of 14 kg (30 pounds) minimum.

**PART 3 - EXECUTION**

**3.1 GENERAL**

A. Do not apply roof insulation if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon.

B. Entire roof deck construction of any section of the building shall be completed before insulation system work is begun. Curbs, blocking, edge strips, and other components which insulation, roofing and base flashing is attached to shall be in place ready to receive insulation and roofing. Coordinate roof insulation operations with roofing and sheet metal work so that insulation is installed to permit continuous roofing operations.

C. Insulation system materials shall be dry and damage free when applied. Do not use broken insulation or insulation with damaged facings. Remove damaged insulation from the site immediately.

D. Dry out surfaces, including the flutes of metal deck, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials only to dry substrates.

E. Except for temporary protection specified, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, fog, snow, ice) or frost is present in any amount in or on the materials when temperature is below 10° C (50° F). Do not apply materials to substrate having temperature of 10° C (50° F) or less.

F. Phased construction is not permitted. The complete installation of all flashing, insulation, and roofing shall be completed in the same day except for the area where temporary protection is required when work is stopped.

G. Temporary Protection for Built-Up Roofing:

1. Install temporary protection consisting of glaze coats and water cutoffs at the end of each day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent.

2. Glaze coat all exposed surfaces of insulation and felts to seal within the bitumen coating. No insulation or felt surfaces or edges shall be left exposed.

3. Provide water cutoffs at exposed edges of insulation. Cutoffs shall consist of two plies of felt. The first ply extending 150 mm (six inches) beyond edge of roof insulation, the roof deck and the built-up roofing. The second ply covering the first ply and extending 75 mm (three inches) beyond the first. Install as specified for vapor retarder. When the work resumes, cut the protective felts along the vertical face of insulation and remove, exposing the edges of the insulation.

4. Securely anchor insulation in place to prevent blow off and damage by construction activities.

5. Provide for removal of water or drainage of water away from work.

6. For roof areas that are to remain intact and that are subject to foot traffic and damage, provide wood walkways with notches in sleepers to permit free drainage.

H. Heating Bitumen:

1. Heat the asphalt to the equiviscous temperature plus or minus 14° C (25° F), at the time of application.

a. Asphalt shall not be heated more than 38° C (100° F) above the equiviscous temperature.

b. When the equiviscous temperature is not furnished by the asphalt manufacturer, asphalt shall not be heated above 274° C (525° F) for Type III and IV and shall be not less than 246° C (475° F) at time of application.

2. At no time shall bitumen be heated above the flash point temperature.

3. Provide heating kettles with a thermometer kept in operating condition. Kettlemen shall be in attendance at all times during heating to insure that the bitumens are heated within the temperatures specified.

I. Use Type III or Type IV asphalt between plies of felt and for installing insulation and vapor retarders.

J. Application of Materials with Hot Bitumen:

1. Apply bitumen in quantities required, immediately followed by materials to be embedded therein, before bitumen cools below the application temperature limit.

a. Do not apply more material than can be covered at one time, except for glaze coats.

b. Recoat cooled bitumen areas.

K. Primer: Use four liters (one gallon) of primer per 10 $m^2$ (100 square feet).

L. Quantities of Asphalt:

1. Per square unless otherwise specified.

2. Between insulation layers and deck or vapor retarder: 9 to 14 kg (20 to 30 pounds).

3. Glaze coats: 7 to 11 kg (15 to 25 pounds).

M. Building Paper (Red rosin):

1. Lay paper smoothly without buckles or wrinkles at right angles to the roof slope, starting at the low point.

2. Lap each sheet of paper at least 50 mm (two inches) over preceding sheet, and at ends.

3. Staple or nail sufficiently to hold in place until the insulation is installed.

**3.2 SURFACE PREPARATION**

A. Sweep decks to broom clean condition. Remove all dust, dirt or debris.

B. Remove projections that might damage materials.

C. Existing Roofs:

1. At areas to be altered or repaired, remove loose insulation and wet insulation.

2. Cut and remove existing insulation and vapor retarder for new work to be installed. Clean cut edges and install a temporary seal to cut surfaces. Use roof cement and one layer of 7 kg (15 pound) felt strip cut to extend 150 mm (6 inches) on each side of cut surface. Bed strip in roof cement and cover strip with roof cement to completely embed the felt.

**3.3 VAPOR RETARDER**

A. General:

1. Install a continuous vapor retarder on roof decks as specified.
2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
3. At all pipes, walls, and similar penetrations through vapor retarder, seal openings with roof cement to prevent moisture entry from below.
4. Seal penetrations with roof cement.

B. Steel Deck:

1. Material and method of application of roofing systems used on metal decks shall meet the requirements of Underwriters Laboratories for Class A or Factory Mutual Research Corporation for Class I Insulated Steel Roof Deck.
2. Locate the long dimension edge joints to have solid bearing on top of decking ribs; do not cantilever over rib openings or flutes.

**3.4 RIGID INSULATION**

A. Insulation Type:

1. Use isocyanurate board.
2. Use not less than two layers of insulation unless specified otherwise.
3. Use 13 mm (1/2 inch) thick mineral fiber board as a top layer over isocyanurate board.
4. Where tapered insulation is used, all insulation shall be factory tapered.
5. Use same insulation as existing for roof repair and alterations unless specified otherwise.

B. Insulation Thickness:

1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the thermal resistance "R" value of not less than 24 for uniform thickness of 4 inches.
2. The minimum thickness of insulation for metal decks shall not be less than recommended by the insulation manufacturer to span the rib opening (flute size) of the metal deck used.
3. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of flashing, gravel stops, fascias and similar items at no additional cost to the Government.
4. Use not less than two layers of insulation when insulation is 25 mm (one inch) or more in thickness unless specified otherwise.

**3.5 INSTALLATION OF INSULATION**

A. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer.

B. Cover all insulation installed on the same day by either:

1. The roofing membrane as specified.

C. Cut to fit tight against blocking or penetrations.

D. Over Vapor Retarder, or Concrete Deck: Lay insulation in hot bitumen as specified.

**- - - E N D - - -**

**SECTION 07 31 13**
**ASPHALT SHINGLES**

## PART 1 - GENERAL

### 1.1 DESCRIPTION

This section specifies organic felt and fiberglass asphalt shingles.

### 1.2 RELATED WORK

A. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.

### 1.3 SUMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:

1. Shingles, each type, color and texture.
2. Ridge vent, each type, color and texture.

C. Manufacturer's Literature and Data:

1. Shingles, each type, including installation instructions.
2. Ridge vent, including installation instructions.

### 1.4 DELIVERY AND STORAGE

A. Deliver materials in manufacturer's unopened bundles or containers with the manufacturer's brand and name clearly marked thereon.

B. Shingle bundle wrapping shall bear the label of Underwriters Laboratories, Inc.

C. Store shingles in accordance with manufacturer's printed instructions. Store roll goods on end in an upright position.

D. Keep materials dry, covered completely and protected from the weather.

### 1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part o this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

| | | |
|---|---|---|
| D226-06 | ..... | Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing |
| D1970-08 | ..... | Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection |
| D2178-04 | ..... | Asphalt Glass Felt used in Roofing and Waterproofing |
| D3018-03 | ..... | Class A Asphalt Shingles Surfaced with Mineral Granules |

| | | |
|---|---|---|
| D3462-07 | ..... | Asphalt, Shingles Made from Glass Felt and Surfaced with Mineral Granules |
| F1667-05 | ..... | Driven Fasteners: Nails, Spikes, and Staples |

C. Underwriter's Laboratories Inc. (UL):

| | | |
|---|---|---|
| UL790-04 | ..... | Fire Tests of Roof Covering |

**1.6 WARRANTY**

Roofing work subject to the terms of the Article "Warranty of Construction" of Section, GENERAL CONDITIONS, except extend the warranty period to fifteen years.

**PART 2 - PRODUCTS**

**2.1 SHINGLES**

A. Class A: (Fire resistive), per UL790. ASTM D3018, Type I and ASTM 3462, square butt for a maximum exposure of 200 mm (8 inches), headlap minimum 50 mm (2 inches), wind resistant, self sealing. Minimum weight: 17.4 Kg/sqm (355 lbs/100sft).

B. Design basis: Centennial Slate, as manufactured by Certainteed. Color/pattern: New England slate

**2.2 RIDGE VENT**

A. Shingle-over style, wind/rain/bug resistant, in color to match roof shingles. Complete with all connectors, end-caps necessary accessories.

**2.3 ROOFING NAILS**

A. ASTM F1667; Type I, Style 20, galvanized steel, deformed shanks, with heads 9.5 mm to 11 mm (3/8-inch to 7/16-inch) diameter.

B. Use nails 32 mm (1-1/4 inches) long for shingles and 19 mm (3/4-inch long) for felt.

**2.4 ROOFING FELT**

A. Fiberglass Felt: ASTM D2178.

B. Organic Felt: ASTM D226, TYPE I.

**PART 3 EXECUTION**

**3.1 PREPARATION**

A. Roof surfaces shall be sound, reasonably smooth and free from defects which would interfere with roofing installation.

B. Roof accessories, vent pipes and other projections through the roof must be in place and roof flashing installed or ready for installation before laying shingles.

**3.2 LAYING**

A. Lay felt under shingles over entire roof.

B. Install asphalt felt underlayment, lapping a minimum of 100 mm (four inches) at ends, 50 mm (2 inches) at head and 300 mm (12 inches) over ridge. Extend felt 13 mm (1/2-inch) beyond edges of roof. Nail felt 125 mm (five inches) on centers along laps.

C. At eaves, install strip of 41 Kg (90 pound) mineral surface roll roofing not less than 460 mm (18 inches) wide and starter course of roof shingles with tabs reversed. Both shall overhang lower edge of roof 13 mm (1/2-inch).

D. Lay shingles with maximum exposure of 125 mm (5 inches). Nail shingles in accordance with manufacturer's published directions.

**3.3 METAL DRIP EDGES**

A. At rakes, install metal drip edges made of stainless steel specified under Section 07 60 00, FLASHING AND SHEET METAL. Apply the metal drip edge directly over the underlayment along the rakes.

B. Secure metal drip edges with compatible nails spaced not more than 250 mm (10 inches) on center along the inner edges.

**3.4 FLASHINGS**

Provide metal flashings specified under Section 07 60 00, FLASHING AND SHEET METAL at the intersections of roofs, adjoining walls, or projections through the deck such as chimneys and vent stacks. Give careful attention to the installation of all flashings.

**3.5 RIDGE VENT**

Install lengthwise down center positioned to provide equal exposure on each side of ridge. Beginning at one end of ridge, secure per manufacturer’s printed instructions. Install end-caps at all exposed ends.

**3.6 VALLEY FLASHING**

A. Install metal valley flashing shown and as specified under Section 07 60 00, FLASHING AND SHEET METAL.

B. Secure valley flashing in accordance with shingle manufacturer's printed instructions.

C. Expose flashing in open portion of valley a minimum of 125 mm (5 inches) and lap the shingles over the flashing a minimum of 125 mm (5 inches).

**3.7 ROOF ACCESSORIES**

Lap shingles over the accessories flashing a minimum of 125 mm (5 inches).

**- - - E N D - - -**

**SECTION 07 32 13**
**CLAY ROOF TILES**

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. This section specifies the installation of clay roofing tiles.

B. Related work:

1. Metal Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
2. Style, size, exposure, color and texture of clay tile: To match existing, manufactured by Ludowici Roof Tiles, 4757 Tile Plant Rd, P.O. Box 69, New Lexington Ohio 43764.
3. Sealants: Section 07 92 00, JOINT SEALANTS.

### 1.2 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples: Tiles to show color range.

C. Shop Drawings: Details of fabricated custom shapes.

### 1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver tiles and setting materials in manufacturer's original, unopened containers clearly identifying manufacturer and the contents.

B. Do not store tiles in flat position.

### 1.4 WARRANTY

Warrant materials and workmanship to be free from defects and leaks and subject to the terms of the "Warranty of Construction", FAR clause 52.246-21, except that warranty period is two years.

### 1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

| | | |
|---|---|---|
| A580-06 | ..... | Stainless Steel Wire |
| B99-06 | ..... | Copper - Silicon Alloy Wire for General Applications |
| C270-07 | ..... | Mortar for Unit Masonry |
| C920-08 | ..... | Elastomeric Joint Sealants |
| C1167-03 | ..... | Clay Roof Tiles |
| D226-06 | ..... | Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing |
| D4586-07 | ..... | Asphalt Roof Cement, Asbestos Free |
| F1667-05 | ..... | Driven Fasteners: Nails, Spikes, and Staples |

**PART 2 - PRODUCTS**

**2.1 CLAY ROOF TILES**

A. For repairs, match existing tile for color and shape. Manufactured by Ludowici Roof Tiles, 4757 Tile Plant Rd, P.O. Box 69, New Lexington Ohio 43764.

B. Special shapes: Eave closures, under eave piece, gable rake, and hands, valley, ridge covers, top fixtures, and other shapes required.

**2.2 ROOF CEMENT**

A. ASTM D4586, Type II.

B. Modified bituminous types are acceptable.

**2.3 NAILS BRADS, STAPLES AND SPIKES**

A. ASTM F1667.

B. Nails: Type I, Style 23, Hard copper roofing nails length for 19 mm (3/4 inch) penetration into deck.

**2.4 FELT UNDERLAYMENT**

A. ASTM D226, Type II, nominal 13.6 kg (30 pounds.)

B. Without perforations.

**2.5 MORTAR**

A. ASTM C270.

B. Type N or 0.

**2.6 SEALANT**

A. ASTM C920, Type S or M, Grade NS Class 25.

B. Use Polyurethane, Shore hardness 15-25.

**2.7 WIRE**

A. Stainless steel: ASTM A580, Type 302 or 304, minimum 0.74 mm (0.029 inch) diameter.

B. Copper: ASTM B99, minimum 1.27 mm (0.05 inch) diameter.

**PART 3 - EXECUTION**

**3.1 JOB CONDITIONS**

A. Do not set tiles in mortar when the ambient temperature is less than 4 °C (40 °F).

B. Do not start installation until other trades requiring traffic on roof have completed their work.

C. Do not start installation until vent pipes and other projections through roofs and flashing materials are in place.

**3.2 LAYING FELT UNDERLAYMENT**

A. Lay single thickness of felt parallel to eaves with double thickness at hips, valleys, and ridges, under tile roofing.

B. Lap horizontal joints 75 mm (3 inches) and vertical joints 150 mm (6 inches) with vertical joints staggered. Lap in direction of flow.

C. Extend felt up 150 mm (6 inches) at abutting vertical walls, chimneys and parapets.

D. Lap felt not less than 100 mm (4 inches) under edges at built-in gutters, valleys, flashing, and metal flashings.

E. Staple felt 125 mm (5 inches) on centers along laps and edges.

**3.3 LAYING TILE**

A. Lay courses parallel with eaves.

B. Do not stretch courses.

C. Space course to finish even and parallel at top of level terminations.

D. Fit tiles closely at ridges, around vent pipes, flashing and other like projections through roof.

E. Secure tile by at least two nails, where practicable.

F. Use copper or stainless steel wire fastening where nails are not used through tile.

G. Cover nails and wire fastenings in finished work.

H. Lay tile with an end lap of at least 75 mm (3 inches).

I. Recess eave closure of pan and cover tile at least 38 mm (1-1/2 inches) from lower end of tile.

J. Fill laps of ends bands, of cover tile on ridges, and of gable rakes to end bands and field tiles with roof cement.

1. Limit amount of roof cement used for leveling tile to 6 mm (1/4 inch) thickness.
2. Use mortar for leveling and bedding tile where thickness exceeds 6 mm (1/4 inch).

K. Use sealant for pointing around eave closures ridge cover joints, and top fixtures.

1. Apply sealant cap bead over exposed fasteners sealing opening.
2. Apply as specified in Section 07 92 00, JOINT SEALANTS.

L. Coordinate with Section 07 60 00, FLASHING AND SHEET METAL for installation of flashing with tile work. Keep flashing concealed except where exposed on vertical surfaces or Counterflashing (cap).

**3.4 CLEANING AND REPAIR**

A. Upon completion remove any cement splatter from tile and adjacent surfaces.

B. Replace broken, cracked, or stained tile with discolored surface.

**- - - E N D - - -**

**SECTION 07 53 23**
**ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING**

## PART 1 GENERAL

### 1.1 DESCRIPTION

A. Ethylene Propylene Diene Monomer (EPDM) sheet roofing ballasted. See roof plans for locations.

B. Fire rated roof system.

### 1.2 RELATED WORK

A. Treated wood framing, blocking, and nailers: Section 06 10 00, ROUGH CARPENTRY

B. Roof Insulation: Section 07 22 00, ROOF AND DECK INSULATION.

C. Metal cap flashings, copings, fascias, and expansion joints: Section 07 60 00, FLASHING AND SHEET METAL

### 1.3 QUALITY ASSURANCE

A. Approved applicator by the membrane roofing system manufacturer, and certified by the manufacturer as having the necessary expertise to install the specific system.

B. Pre-Roofing Meeting:

1. Prior to any roofing demolition or application, hold a pre-roofing meeting arranged by the Contractor and attended by the Roofing Inspector, Material Manufacturers Technical Representative, Roofing Applicator, Contractor, and COTR,

2. Discuss specific expectations and responsibilities, construction procedures, specification requirements, application, environmental conditions, job and surface readiness, material storage, and protection.

3. Inspect roof deck at this time to:

a. Verify that work of other trades which penetrates roof deck is completed.

b. Determine adequacy of deck anchorage, presence of foreign material, moisture and unlevel surfaces, or other conditions that would prevent application of roofing system from commencing or cause a roof failure.

c. Examine samples and installation instructions of manufacturer.

d. Perform pull out test of fasteners (See paragraph 3.2).

### 1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Applicators approval certification by manufacturer.

C. Manufacture’s literature and data for all roofing components used.

D. Shop Drawings:

1. Sheet membrane layout.

2. Fastener pattern, layout, and spacing requirements.

3. Termination details.

E. Manufacturers installation instructions revised for project.

F. Samples:

1. Sheet membrane: One 150 mm (6 inch) square piece.
2. Sheet flashing: One 150 mm (6 inch) square piece.
3. Fasteners: Two, each type.
4. Welded seam: Two 300 mm (12 inch) square samples of welded seams to represent quality of field welded seams.

**1.5 DELIVERY, STORAGE AND HANDLING**

A. Deliver, store, and handle materials as specified by manufacturer.

B. Store volatile materials separate from other materials with separation to prevent fire from damaging the work, or other materials.

**1.6 WARRANTY**

Roofing work subject to the terms of the Article “Warranty of Construction” of Section 01001, GENERAL CONDITIONS, except extend the warranty period to fifteen years.

**1.7 APPLICABLE PUBLICATIONS**

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

| | | |
|---|---|---|
| A167-99 | ..... | Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip |
| B209-02 | ..... | Aluminum and Aluminum-Alloy Sheet and Plate |
| D751-00 | ..... | Coated Fabrics |
| D2103-97 | ..... | Polyethylene Film and Sheeting |
| D2240-02 | ..... | Rubber Property - Durometer Hardness |
| D3884-01 | ..... | Abrasive Resistance of Textile Fabrics (Rotary Platform, Double-Head Method) |
| D4637-96 | ..... | EPDM Sheet Used in Single-Ply Roof Membrane |
| D4586-00 | ..... | Asphalt Roof Cement, Asbestos Free |
| E96-00 | ..... | Water Vapor Transmission of Materials |
| E108-00 | ..... | Fire Tests of Roof Coverings |
| G21-96 | ..... | Resistance of Synthetic Polymeric Materials to Fungi |

C. National Roofing Contractors Association (NRCA):

| | | |
|---|---|---|
| Fifth Edition | ..... | The NRCA Roofing and Waterproofing Manual. |

D. Federal Specifications (Fed. Spec.)

| | | |
|---|---|---|
| FF-S-107C(2) | ..... | Screws, Tapping and Drive |
| FF-S-111D(1) | ..... | Screw, Wood |

UU-B-790A ..... Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent and Fire Resistant)

E. Factory Mutual Engineering and Research Corporation (FM):

Annual Issue ..... Approval Guide Building Materials

F. Underwriters Laboratories, Inc (UL):

Annual Issue ..... Building Materials Directory

Annual Issue ..... Fire Resistance Directory

G. Warnock Hersey (WH):

Annual Issue ..... Certification Listings

**PART 2 - PRODUCTS**

**2.1 EPDM SHEET ROOFING**

A. Conform to ASTM D4637, Type I, Grade 1, white color.

B. Additional Properties:

| PROPERTY | TEST METHOD | REQUIREMENT |
|---|---|---|
| Shore A Hardness | ASTM D2240 | 55 to 75 Durometer |
| Water Vapor Permeance | ASTM E96 | Minimum 0.14 perms Water Method |
| Fungi Resistance | ASTM G21 | After 21 days, no sustained growth or discoloration. |
| Fire Resistance | ASTM E108 Class A | No Combustion Beyond Flame/Heat Source |

C. Thickness:

1. Use 1.14 mm (0.045-inch) (minimum) thick sheet for ballasted system.

**2.2 EPDM FLASHING SHEET**

A. Conform to ASTM D4637, Type I, Grade 1, Class U, unreinforced, color, same as roof membrane modified as specified for flashing.

B. Self curing EPDM flashing, adaptable to irregular shapes and surfaces.

C. Minimum thickness 1.5 mm (0.0600-inch).

**2.3 MISCELLANEOUS ROOFING MEMBRANE MATERIALS**

A. Sheet roofing manufacturers specified products.

B. Splice Adhesive: For roofing and flashing sheet.

C. Lap Sealant: Liquid EPDM rubber for roofing sheet exposed lap edge.

D. Bonding Adhesives: Neoprene, compatible with roofing membrane, flashing membrane, insulation, metals, concrete, and masonry for bonding roofing and flashing sheet to substrate.

E. Fastener Sealer: One part elastomeric adhesive sealant.

F. Temporary Closure Sealers (Night Sealant): Polyurethane two part sealer.

G. Primers, Splice Tapes, Cleaners, and Butyl Rubber Seals: As specified by roof membrane manufacturer.

**2.4 FASTENERS**

A. Fasteners and washers required for securing sheet roofing to deck:

1. Steel stress plate washers as required by sheet roofing manufacturer:
   a. Coated against corrosion.
   b. Separate or attached to fastener.
   c. Approximately 50 mm (2 inch) diameter or 40 mm x 65 mm (1-1/2 by 2-1/2 inches) rectangular plate with rounded corners, minimum thickness 0.6 mm (0.023-inch).
2. Fastening strip or batten strip for securing roof membrane to deck:
   a. Stainless steel strip: ASTM A167 type 302 or 304, minimum 0.5 mm (0.018-inch) thick.
   b. Rounded corners on strips.
   c. Form strips 38 mm (1-1/2 inches) wide, 3000 mm (10 feet) maximum length with 6 mm x 10 mm (1/4 by 3/8 inch) punched slotted holes at 100 mm (4 inch) centers; centered on width of strip. Punch holes 2 mm (1/16 inch) larger than fastener shank when shank is larger than 5 mm (3/16 inch).
3. Steel decks: Screws; Fed Spec FF-S-107, hardened nylon screw or steel screw coated to resist corrosion, self drilling, anti-backout thread design. Minimum pullout resistance of 135 Kg (300 pounds), minimum thread penetration of 13 mm (1/2 inch).
4. Washers: Neoprene backed metal washer 28 mm (1-1/8 inch) minimum diameter.
5. To Sheet Metal: Self tapping screw; Fed. Spec. FF-S-107, 2 mm (No. 14), sheet metal screw, minimum thread penetration of 6 mm (1/4 inch); stainless steel.

**2.5 VAPOR RETARDER OR SEPARATION SHEETS**

A. Polyethylene film: ASTM D2103, 0.2 mm (6 mils) thick.

B. Building Paper: Fed. Spec. UU-B-790.

1. Water vapor resistance: Type I, Grade A, Style 4, reinforced.
2. Water vapor permeable: Type I, Grade D, Style 4, reinforced.

**2.6 PROTECTION MAT OR SEPARATION SHEETS**

A. Protection Mat:

1. Water pervious; either woven or non-woven pervious sheet of long chain polymeric filaments or yarns such as polypropylene, black polyethylene, polyester, or polyamide; or, polyvinylidene-chloride formed into a pattern with distinct and measurable openings.
2. Filter fabric equivalent opening size (EOS): Not finer than the U.S.A. Standard Sieve Number 120 and not coarser than the U.S.A. Standard Sieve Number 100. EOS is defined as the number of the U.S.A. Standard Sieve having openings closest in size to the filter cloth openings.
3. Edges of fabric selvaged or otherwise finished to prevent raveling.

4. Abrasion resistance:
   a. After being abraded in conformance with ASTM D3884 using rubber-hose abrasive wheels with one kg load per wheel and 1000 revolutions, perform tensile strength test as specified in ASTM D1682, paragraph.
   b. Result; 25 kg (55 pounds) minimum in any principle direction.
5. Puncture strength:
   a. ASTM D751 - tension testing machine with ring clamp; steel ball replaced with a 8 mm (5/16 inch) diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.
   b. Result; 57 kg (125 pounds) minimum.
6. Non-degrading under a wet or humid condition within minimum 4°C (40°F) to maximum 66°C (150°F) when exposed to ultraviolet light.
7. Minimum sheet width: 2400 mm (8 feet).

**2.7 BALLAST**

A. Aggregate:
   1. Conform to ASTM D1863.
   2. Gradation conform to ASTM D448:
      a. Size 2 for 146 kg/$m^2$ (30 pounds per square foot) or more.
      b. Size 3 for 122 kg/$m^2$ (25 pounds per square foot) or more.
      c. Size 5 for 73 kg/$m^2$ (15 pounds per square foot) or more.
      d. Size 6 for 49 kg/$m^2$ (10 pounds per square foot) or more.

**PART 3 - EXECUTION**

**3.1 GENERAL**

A. Do not apply if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless protection provided to distribute loads less than one-half compression resistance of roofing system materials.
   1. Curbs, blocking, edge strips, and other components to which roofing and base flashing is attached in place ready to receive insulation and, roofing.
   2. Coordinate roof operation with sheet metal work and roof insulation work so that insulation and flashing are installed concurrently to permit continuous roofing operations.
   3. Complete installation of flashing, insulation, and roofing in the same day except for the area where temporary protection is required when work is stopped.

B. Phased construction is not permitted. The complete installation of roofing system is required in the same day except for area where temporary protection is required when work is stopped.

C. Dry out surfaces that become wet from any cause during progress of the work before roofing work is resumed.

D. Apply materials only to dry substrates.

E. Except for temporary protection specified, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, fog, ice, or frost) is present in any amount in or on the materials.

1. Do not apply materials to substrate having temperature of 4°C (40 degrees F) or less, or when materials applied with the roof require higher application temperature.
2. Do not apply materials when the temperature is below 4°C (40 degrees F).

F. Temporary Protection:

1. Install temporary protection consisting of a temporary seal and water cut-offs at the end of each day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent.
2. Temporarily seal exposed surfaces of insulation within the roofing membrane.
3. Do not leave insulation surfaces or edges exposed.
4. Use polyethylene film or building paper to separate roof sheet from bituminous materials.
5. Apply the temporary seal and water cut off by extending the roof membrane beyond the insulation and securely embedding the edge of the roof membrane in 6 mm (1/4 inch) thick by 50 mm (2 inches) wide strip of temporary closure sealant (night sealant) and weight edge with sandbags, to prevent displacement; space sandbags not over 2400 mm (8 foot) centers. Check daily to insure temporary seal remains watertight. Reseal open areas and weight down.
6. Before the work resumes, cut off and discard portions of the roof membrane in contact with roof cement or bituminous materials.
   a. Cut not less than 150 mm (6 inches) back from bituminous coated edges or surfaces.
   b. Remove temporary polyethylene film or building paper.
7. Remove and discard sandbags contaminated with bituminous products.
8. For roof areas that are to remain intact and that are subject to foot traffic and damage, provide temporary wood walkways with notches in sleepers to permit free drainage.
9. Provide 2 mm (6 mil) polyethylene sheeting or building paper cover over roofing membrane under temporary wood walkways and adjacent areas. Round all edges and corners of wood bearing on roof surface.

**3.2 PREPARATION**

A. Test pull out resistance of fasteners in deck in the presence of the COTR before starting roofing work. Tests are not required for wood.

1. Test applicable fastener type in applicable deck.
2. Install fasteners through a sample of the insulation, if any is to be used, into the structural deck.
3. Test the pull out resistance with a pull out tester.
4. Test one fastener in each deck level and one for every 230 m² (2500 square feet) of deck type and level.

5. Test at locations designated by COTR.
6. Do not proceed with the roofing work if the pull out resistance of the fasteners is less than specified.
7. Test results:
   a. Repeat tests using other type fasteners or use additional fasteners to stay within the pullout load resistance criteria.
   b. Patch cementitious deck to repair areas of fastener tests holes.

B. Remove dirt, debris, and surface moisture. Cover or fill voids greater than 6 mm (1/4 inch) wide to provide solid support for roof membrane.

**3.3 INSTALLATION OF ROOFING AND FLASHING**

A. Do not allow the membrane to come in contact with surfaces contaminated with asphalt, coal tar, oil, grease, or other substances which are not compatible with EPDM roofing membrane.

B. If possible, install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.

C. If possible, start at the low point of the roof and work towards the high point. Lap the sheets so the flow of water is not against the edges of the sheet. Coordinate with roof insulation installation.

D. Position the membrane so it is free of buckles and wrinkles.

E. Roll sheet out on deck; inspect for defects as sheet is being rolled out and remove defective areas.

1. Allow 30 minutes for relaxing before proceeding.
2. Lap edges and ends of sheets 75 mm (3 inches) or more as recommended by the manufacturer. Clean lap surfaces as specified by manufacturer.
3. Adhesively splice laps. Apply pressure as required. Seam strength of laps as required by ASTM D4637.
4. Check seams to ensure continuous adhesion and correct defects.
5. Finish edges of laps with a continuous beveled bead of lap sealant to sheet edges to provide smooth transition as specified by manufacturer.
6. Finish seams as the membrane is being installed (same day).
7. Anchor perimeter to deck or wall as specified.

F. Membrane Perimeter Anchorage:

1. Install batten strip or steel stress plate with fasteners at the perimeter of each roof level, curb flashing, expansion joints and similar penetrations as indicated in accordance with membrane manufacturer's instructions on top of roof membrane to wall or deck.
2. Mechanically fastened as follows:
   a. Top of mechanical fastener set flush with top surface of the nailing strip or stress plate.
   b. Space mechanical fasteners a maximum 300 mm (12 inches) on center.
   c. Start 25 mm (1 inch) from the end of the nailing strip when used.

d. When strip is cut round edge and corners before installing.

e. Set fasteners in lap sealant and cover fastener head with fastener sealer including batten strip or stress plate.

f. Stop fastening strip where the use of the nailing strip interferes with the flow of the surface water, separate by a 150 mm (6 inch) space, then start again.

g. After mechanically fastening cover and seal with a 225 mm (9 inch) wide strip of flashing sheet. Use splice adhesive on all laps and finish edge with sealant as specified.

h. At gravel stops facia-cants turn the membrane down over the front edge of the blocking, cant, or the nailer to below blocking. Secure the membrane to the vertical portion of the nailer; with fasteners spaced not over 150 mm (6 inches) on centers.

i. At walls, intersecting building walls and curbs, secure the membrane to the structural deck with fasteners 150 mm (6 inches) on center or as shown in NRCA manual (Fifth Edition)

G. Install flashings as the membrane is being installed (same day). If the flashing cannot be completely installed in one day, complete the installation until the flashing is in a watertight condition and provide temporary covers or seals.

H. Flashing Roof Drains:

1. Install roof drain flashing as recommended by the membrane manufacturer, generally as follows:

a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.

b. Do not allow the roof cement to come in contact with the EPDM roof membrane.

c. Adhere the EPDM roof membrane to the metal flashing with the membrane manufacturer's recommended bonding adhesive.

2. Turn down the metal drain flashing and EPDM roof membrane into the drain body and install clamping ring and stainer.

I. Installing EPDM Base Flashing:

1. Install EPDM flashing membranes to pipes, walls or curbs to a height not less than 200 mm (8 inches) above roof surfaces and 100 mm (4 inches) on roof membranes. Install in accordance with NRCA manual.

a. Adhere flashing to pipe, wall or curb with bonding adhesive.

b. Form inside and outside corners of EPDM flashing membrane in accordance with NRCA manual (Fifth Edition). Form pipe flashing in accordance with NRCA manual (Fifth Edition).

c. Lap ends not less than 100 mm (4 inches).

d. Adhesively splice flashing membranes together and flashing membranes to roof membranes. Finish exposed edges with sealant as specified.

2. Anchor top of flashing to walls or curbs with fasteners spaced not over 150 mm (6 inches) on center. Use surface mounted fastening strip with sealant on ducts. Use pipe clamps on pipes or other round penetrations.
3. Apply sealant to top edge of flashing.

J. Repairs to membrane and flashings:
1. Remove sections of EPDM sheet roofing or flashing that is creased wrinkled or fishmouthed.
2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (4 inches) beyond damaged, cut, or removed area. Adhesively splice to roof membrane or flashing. Finish edge of lap with sealant as specified.

**3.4 FIELD QUALITY CONTROL**

A. Examine and probe seams in the membrane and flashing in the presence of the COTR and Membrane Manufacturer's Inspector.

B. Probe the edges of welded seams with a blunt tipped instrument. Use sufficient hand pressure to detect marginal bonds, voids, skips, and fishmouths.

C. Cut 100 mm (4 inch) wide by 300 mm (12 inch) long samples through the seams where directed by the COTR.
1. Cut one sample for every 450 m (1500 linear feet) of seams.
2. Cut the samples perpendicular to the longitudinal direction of the seams.
3. Failure of the samples to maintain the standard of quality within a reasonable tolerance of the approved samples will be cause for rejection of the work.

D. Repair areas of welded seams where samples have been taken or marginal bond voids or skips occur.

E. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (4 inches) beyond cut.

**3.5 INSTALLATION OF BALLAST SYSTEM**

A. Install as soon as roof membrane is laid.

B. Protective underpayment installation under ballast:
1. Loose lay protection mat or separation sheet over roof membrane smooth and free of tension and stress without wrinkles. Do not stretch sheet.
2. Use full sheet width at perimeters with end laps held back not less than 3 m (10 feet) from roof edge at corners.
3. Lap ends not less than 300 mm (one foot).
4. Extend 50 to 75 mm (2 to 3 inches) above ballast at perimeter and penetrations.

C. Installation of aggregate:
1. Place aggregate as required by roof manufacturer.

**3.6 WALKWAY PADS**

A. Clean membrane where pads are applied.

B. Adhere pads to membrane with splicing cement.

C. Allow not less than 1 inch break between pads and 2 inch maximum break.

**3.7 TEMPORARY ROOF**

A. Install temporary roof when sequences of work or weather does not permit installation of a completed permanent roof system or roof would be subject to phasing of roof work, construction traffic, scaffolds, and work over roof area.

B. Use of 1.15 mm (0.045-inch) thick non-reinforced EPDM membrane or other temporary membrane as approved.

C. Install not less than 6 mm (1/4 inch) thick plywood underlayment over steel decks before installing temporary roof.

D. Secure membrane to deck with mechanical fasteners or temporary ballast not exceeding deck dead load capacity.

E. Repair cuts, tears, and punctures with patches to keep system watertight.

**- - - E N D - - -**

**SECTION 07 60 00**
**FLASHING AND SHEET METAL**

## PART 1 - GENERAL

### 1.1 DESCRIPTION

Formed sheet metal work for flashing and insulated expansion joint covers are specified in this section.

### 1.2 RELATED WORK

A. Roofing: Section 07 31 13, ASPHALT SHINGLES; 07 32 13, CLAY ROOF TILES.

B. Single ply base flashing system: Section 07 53 23, ETHYLENE PROPYLENE DIENE MONOMER SHEET ROOFING.

C. Sealant compound and installation: Section 07 92 00, JOINT SEALANTS.

### 1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SAMPLES AND SHOP DRAWINGS.

B. Shop Drawings:

Flashings
Hung Gutter and Conductors
Fascia
Built-in Gutter Liner
Expansion Joints
Valley Flashing
Drip Edge

C. Manufacturer's Literature and Data:

Thru wall flashing
Expansion joint cover, each type
Reglet
Copper
Fascia
Underlayment

D. Certificates: Stating that aluminum has been given – specified finish. Coating formulators approvals as specified.

### 1.4 APPLICABLE PUBLICATIONS

A. The publications listed below for a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

| | |
|---|---|
| B32-04..... | Solder Metal |
| B209-04..... | Aluminum and Aluminum-Alloy Sheet and Plate |
| B370-03..... | Copper Sheet and Strip for Building Construction |

D173-03 ..... Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
D412-98 (R2002) ..... Vulcanized Rubber and Thermoplastic Elastomers-Tension
D1187-97 (R2002) ..... Asphalt Base Emulsions for Use as Protective Coatings for Metal
D1784-03 ..... Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
D4586-00 ..... Asphalt Roof Cement, Asbestos Free

C. American National Standards Institute/Single Ply Roofing Institute (ANSI/SPRI):
ES-1-2003 ..... Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual (Fifth Edition, 1993).

E. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series ..... Metal Finishes Manual

F. American Architectural Manufacturers Association (AAMA):
605-98 ..... Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions Panels

G. Federal Specification (Fed. Spec):
A-A-1925A..... Shield, Expansion; (Nail Anchors)
UU-B-790A..... Building Paper, Vegetable Fiber

H. International Building Code (IBC):
2003 Edition

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.

B. Copper: ASTM B370, cold-rolled temper.

C. Bituminous Paint: ASTM D1187, Type I.

D. Fasteners:
1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and stainless steel or aluminum for aluminum alloy.
2. Nails:
a. Minimum diameter for copper nails: 3 mm (0.109 inch).
b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.

d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.

3. Rivets: Not less than 3 mm (1/8 inch)diameter.

4. Expansion Shields: Fed Spec A-A-1925A.

e. Sealant: As specified in Section JOINT SEALANTS for exterior locations.

F. Roof Cement: ASTM D4586.

G. Underlayment: Cold-applied, self-adhering membrane composed of a high density, cross laminated polyethylene film coated on one side with a layer of rubberized asphalt adhesive. Have an embossed, slip resistant surface provided on the polyethylene. Membrane shall conform to the physical properties as listed below:

1. Color: Gray-black.

2. Thickness, membrane: 40 mil (1.02 mm), ASTM D3767 procedure A (section 9.1).

3. Tensile strength, membrane: 250 psi (1720 $kN/m^2$), ASTM D412 (Die C modified).

4. Elongation, membrane: 250%, ASTM D412 (die C modified).

5. Low temperature flexibility: Unaffected @$-20^0$ F ($-29^0$ C), ASTM D1970.

6. Adhesion to plywood: 2.0 lbs/in. width (525 N/m), ASTM D903.

7. Permeance (max): 0.05 Perms (2.9 $ng/m^2s$ Pa), ASTM E96.

**2.2 SHEET METAL THICKNESS**

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:

B. Concealed Locations (Built into Construction):

1. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).

C. Exposed Locations:

1. Copper: 0.5 kg (20 oz).

2. Stainless steel: 0.4 mm (0.015 inch).

D. Thickness of aluminum or galvanized steel is specified with each item.

**2.3 FABRICATION, GENERAL**

A. Jointing:

1. In general, copper and stainless steel joints except expansion and contraction joints, shall be locked and soldered.

2. Jointing of copper over 0.4 Kg (16 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.

3. Joints shall conform to following requirements:

a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.

b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.

c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.

4. Flat and lap joints shall be made in direction of flow.

5. Edges of bituminous coated copper, shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:
   a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper.
   b. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
   c. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:
1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for copper and stainless steel at intervals not exceeding 7200 mm (24 feet).
4. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
5. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:
1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:
1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 0.6 Kg (24 ounce) copper.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).

6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1 Kg (32 oz) copper.

E. Drips:

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat.
3. All metal roof edges shall meet requirements of IBC 2003.

**2.4 FINISH**

A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.

B. In accordance with NAAMM Metal Finishes Manual, unless otherwise specified.

C. Finish exposed metal surfaces as follows, unless specified otherwise:

1. Copper: Mill finish.
2. Stainless Steel: Finish No. 2B or 2D.

**2.5 THROUGH-WALL FLASHINGS**

A. For Masonry Work When Concealed

1. Bitumen-saturated fabric bonded to copper.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Cut flush with face of masonry.

B. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:

1. Use same metal and thickness as counter flashing.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portion as snap lock receiver for counter flashing upper edge.

**2.6 BASE FLASHING**

A. Use metal base flashing where shown.

1. Use copper thickness specified unless specified otherwise.
2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.4 Kg (16 oz) copper or 0.5 mm (0.018 inch) stainless steel.
3. Use either copper, or stainless steel at pipe flashings.

B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).
C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.
D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.
E. Pipe Flashing: (Other than engine exhaust or flue stack)
    1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
    2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
    3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
        a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
        b. Allow for loose fit around and into the pipe.
    4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
        a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
        b. Allow for loose fit around pipe.

**2.7 COUNTERFLASHING (CAP FLASHING OR HOODS)**

A. Either copper or stainless steel, unless specified otherwise.
B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip.
    1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
    2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
    3. Two-piece, lock in type flashing may be used in lieu of one piece counter-flashing.
    4. Manufactured assemblies may be used.
    5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
    6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.
C. One-piece Counterflashing.
    1. Back edge turned up and fabricate to lock into reglet in concrete.
    2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).
D. Two-Piece Counterflashing:

1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
2. Counterflashing upper edge designed to snap lock into receiver.

E. Surface Mounted Counterflashing; one or two piece:
1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

F. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

**2.8 HANGING GUTTERS**

A. Fabricate gutters of 0.4 kg (16 oz) copper. Profile to match existing.
B. Fabricate hanging gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.
C. Building side of gutter shall be not less than 38 mm (2 inches) minimum higher than exterior side.
D. Gutter Bead: Stiffen outer edge of gutter by folding edge over to match existing profile.
E. Gutter Spacers:
1. Fabricate of same material and thickness as gutter.
2. Fabricate 25 mm (one inch) wide strap and fasten to gutters not over 900 mm (36 inches) on center.
3. Turn back edge up 25 mm (one inch) and lap front edge over gutter bead.
4. Rivet and seal to gutter.

F. Outlet Tubes:
1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters extend into the conductor 75 mm (3 inch). Flange upper end of outlet tube 13 mm (1/2 inch).
2. Seal longitudinal seam.
3. Seal aluminum tube to gutter and rivet to gutter.
4. Fabricate basket strainers of same material as gutters.

G. GUTTER BRACKETS:

1. Fabricate of same metal as gutter.
2. Fabricate to gutter profile.
3. Drill two 5 mm (3/16 inch) diameter holes in anchor leg for countersunk flat head screws.

**2.9 VALLEY FLASHING**

A. Fabricate valley of 0.4 kg (16-oz.) copper and in accordance with ARCHITECTURAL SHEET METAL MANUAL Plate 61.

B. Form in one piece in not less than 3-meter (10-foot) sections with 26-mm (1-inch) “V” crimp slash diverter rib at the flow line.

**2.10 BUILT-IN GUTTER LINER**

A. Fabricate in accordance with ARCHITECTURAL SHEET METAL MANUAL.

B. Fabricate gutters of not less than 0.4 Kg (16-oz) copper.

C. Fabricate liners for built-in gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.

D. Outlet Tubes:

1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters. Extend outlet tube into the conductor 75 mm (3 inch).
2. Fabricate basket strainers of same material as gutters.

**2.11 CONDUCTORS (DOWNSPOUTS)**

A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long with 19 mm (3/4 inch) wide flat locked seams. Profile to match existing.

B. Fabricate elbows by mitering, riveting, and sealing aluminum. Lap upper section to the inside of the lower piece.

C. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (one inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual Plate 34, Design C for rectangular shapes and E for round shapes.

**2.12 GRAVEL STOPS/ FASCIA**

A. General:

1. Fabricate in lengths not less than 2400 mm (8 feet) long and maximum of 3000 mm (10 feet).
2. Fabricate internal and external corners as one-piece with legs not less than 600 mm (2 feet) or more than 1200 mm (4 feet) long.
3. Fabricate roof flange not less than 100 mm (4 inches) wide.
4. Fabricate top edge to extend above roof not less than 25 mm (one inch) for embedded gravel aggregate and not less than 100 mm (4 inches) for loose laid ballast.
5. Fabricate lower edge outward at an angle of 45 degrees to form drip and as fascia or as counter flashing as shown:

a. Fabricate of one-piece material of suitable width for fascia height of 250 mm (10 inch) maximum or counterflashing lap of not less than 100 mm (4 inch) over base flashing.
b. Fabricate bottom edge of formed fascia to receive edge strip.
c. When fascia bottom edge forms counter flashing over roofing lap roofing not less than 150 mm (6 inches).

B. Formed Flat Sheet Metal Gravel Stops and Fascia:
1. Fabricate as shown of 0.4 Kg (16 ounce) copper
2. When fascia exceeds 150 mm (6 inches) in depth, form one or more horizontal stops not less than 13 mm (1/2 inch) high in the fascia.
3. Fabricate as two-piece fascia when fascia depth exceeds 250 mm (10 inches).
4. At joint between ends of sheets, provide a concealed clip soldered or welded near one end of each sheet to hold the adjoining sheet in lapped position. The clip shall be approximately 100 mm (4 inches) wide and shall be the full depth of the fascia less 25 mm (one inch) at top and bottom. Clip shall be of the same thickness as the fascia.
5. Provide edge strip as specified with lower hooked edge bent outward at an angle of 45 degrees.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. General:
1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Apply a layer of underlayment to wood surfaces to be covered with copper. Lap each layer 50 mm (2 inch) with the slope and nail with large headed copper nails.
6. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
7. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.

8. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
9. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
10. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
11. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
12. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with waterproof building paper, or a coat of bituminous paint.
13. Isolate aluminum in contact with dissimilar metals other than stainless steel, white bronze or other metal compatible with aluminum by:
    a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    b. Paint dissimilar metal with a coat of bituminous paint.
    c. Apply an approved caulking material between aluminum and dissimilar metal.
14. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
15. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.

**3.2 THROUGH-WALL FLASHING**

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches)and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge flush with face of wall where not part of counter flashing.
5. Turn back edge up 200 mm (8 inches) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges flush with face of wall.
8. Lap end joints not less than 100 mm (4 inches). Seal laps with sealant.

9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 079200, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (one inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.

B. Flashing at Masonry, Stone, or Precast Concrete Copings:
1. Install flashing flush with both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

**3.3 BASE FLASHING**

A. Install where roof membrane type base flashing is not used and where shown.
1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.

**3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)**

A. General:
1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:
1. Where flashing is installed in reglet insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.

C. When counter flashing is a component of other flashing install as shown.

**3.5 HANGING GUTTERS**

A. Hang gutters with high points equidistant from downspouts. Slope at not less than 1:200 (1/16 inch per foot).

B. Lap joints, except for expansion joints, at least 25 mm (one inch) in the direction of flow. Rivet and seal lapped joints.

C. Support gutters in brackets spaced not more than 600 mm (24 inch) on centers, brackets attached to facial or wood nailer by at least two screws or nails.

1. For aluminum gutters use aluminum brackets or stainless steel brackets.
2. Use brass or stainless steel screws.

D. Secure brackets to gutters in such a manner as to allow free movement of gutter due to expansion and contraction.

E. Outlet Tubes: Set bracket strainers loosely into gutter outlet tubes.

**3.6 VALLEY FLASHING**

A. Install in accordance with ARCHITECTURAL SHEET METAL MANUAL Plate 61.

1. A 762-mm (30-inch) wide underlayment shall be placed in the valley. Underlayment in the valley shall be lapped 152-mm (6-inches) over the upper ends of the valley flashing. The underlayment shall lap over the cleated edges of the flashing.
2. Apply a continuous bead of mastic between the copper valley flashing and the roof shingle.
3. The open portion of the valley shall be a minimum of 127-mm (5-inches) and the shingle shall overlap the flashing a minimum of 127-mm (5-inches).
4. The edges of the valley shall be formed with a hook edge and cleated on 610-mm (24-inch) centers.
5. Sections shall be overlapped 203-mm (8-inches) in the direction of the flow. The top of each section shall be fastened with nails of material compatible with the flashing.

**3.7 BUILT-IN GUTTER LINER**

A. Fabricate gutter liner for built-in gutter per ARCHITECTURAL SHEET METAL MANUAL.

1. All joints must be locked and soldered.
2. Install liner over a layer of smooth building paper.

B. Gutter Expansion Joint:

1. All expansion joints shall comply with ARCHITECTURAL SHEET METAL MANUAL.
2. Locate expansion joints midway between outlet tubes or as shown on the drawings.
3. Provide expansion joint space between end baffles of gutters as required by ARCHITECTURAL SHEET METAL MANUAL.
4. Install a cover plate over the space at expansion joint.
5. Fasten cover plates to gutter section on one side of expansion joint only.

6. Secure loose end of cover plate to gutter section on other side of expansion joint by a loose-locked slip joint.

C. Outlet Tubes: Set bracket strainers loosely into gutter outlet tubes.

**3.8 CONDUCTORS (DOWNSPOUTS)**

A. Set conductors plumb and clear of wall, and anchor to wall with two anchor straps, located near top and bottom of each section of conductor. Strap at top shall be fixed to downspout, intermediate straps and strap at bottom shall be slotted to allow not less than 13 mm (1/2 inch) movement for each 3000 mm (10 feet) of downspout.

B. Install elbows, offsets and shoes where shown and required. Slope not less than 45 degrees.

**3.9 GRAVEL STOPS/FASCIA**

A. General:

1. Install gravel stops and fascias with allowance for expansion at each joint; minimum of 6 mm (1/4 inch).
2. Extend roof flange of gravel stop and splice plates not less than four inches out over roofing and nail or screw to wood nailers. Space fasteners on 75 mm (3 inch) centers in staggered pattern.
3. Install continuous cleat for fascia drip edge. Secure with fasteners as close to lower edge as possible on 75 mm (3 inch) centers.
4. Where ends of gravel stops and fascias abut a vertical wall, provide a watertight, flashed and sealant filled joint.
5. Set flange in roof cement when installed over built-up roofing.
6. Edge securement for low-slope roofs: Low-slope membrane roof systems metal edge securement, except gutters, shall be designed in accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from Figure 1609, of IBC 2003.

B. Sheet metal gravel stops and fascia:

1. Install with end joints of splice plates sheets lapped three inches.
2. Hook the lower edge of fascia into a continuous edge strip.
3. Lock top section to bottom section for two piece fascia.

**- - - END - - -**

**SECTION 07 71 00**
**ROOF SPECIALTIES**

## PART 1 - GENERAL

### 1.1 DESCRIPTION

This section specifies equipment supports; and gravity ventilators.

### 1.2 RELATED WORK

A. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION

### 1.3 QUALITY CONTROL

A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.
B. Each accessory type shall be the same and be made by the same manufacturer.
C. Each accessory shall be completely assembled to the greatest extent possible before delivery to the site.

### 1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Samples: Representative sample panel of color anodized aluminum not less than 100 mm X 100 mm (four by four inches), except extrusions shall be a width not less than section to be used. Sample shall show coating with integral color and texture and shall include manufacturer's identifying label.
C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
D. Manufacturer's Literature and Data: Each item specified.
E. Certificates: Stating that aluminum has been given specified thickness of anodizing.

### 1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
B. Federal Specifications (Fed. Spec.):

| | |
|---|---|
| RR-G-1602D ..... | Grating, Metal, Other Than Bar Type (Floor, Except for Naval Vessels) |

C. American Society for Testing and Material (ASTM):

| | |
|---|---|
| A653/A653M-02 ..... | Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process |
| B209/209M-02..... | Aluminum and Aluminum Alloy-Sheet and Plate |

| | |
|---|---|
| B221/221M-02..... | Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes |
| B370-03..... | Copper Sheet and Strip for Building Construction |
| C612-00 ..... | Mineral Fiber Block and Board Thermal Insulation |
| D1187-97 ..... | Asphalt-Base Emulsions for Use as Protective Coatings for Metal |

D. National Association of Architectural Metal Manufacturers (NAAMM):

| | |
|---|---|
| AMP 500 Series ..... | Metal Finishes Manual |

E. American Architectural Manufacturers Association (AAMA):

| | |
|---|---|
| 605-98 ..... | High Performance Organic Coatings on Architectural Extrusions and Panels. |

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

A. Aluminum, Extruded: ASTM B221/B221M.
B. Aluminum Sheet: ASTM B209/B209M.
C. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.
D. Copper: ASTM B370, cold-rolled temper

**2.2 EQUIPMENT SUPPORTS**

A. Fabricate equipment supports from 1.3 mm (0.0516 inch) thick galvanized steel.
B. Form exterior curb with integral base, and deck closures for curbs installed on steel decking.
C. Use galvanized steel liners for curbs having inside dimension over 305 mm (12 inches).
D. Fabricate curb with a minimum height of 200 mm (8 inches) above roof surface.
E. Attach preservative treated wood nailers to top of curb. Use 50 mm (2 inch) by 50 mm (2 inch) minimum nominal size on curb with openings and 50 mm (2 inch) thick, width of curb up to 300 mm (12 inches) on equipment support curbs.
F. Make size of supports suit size of equipment furnished, with height as shown on drawings, but not less than 200 mm (8 inches) above roof surface.

**2.3 LOW SILHOUETTE GRAVITY VENTILATORS**

A. Fabricate base of 1 mm (0.04 inch) thick aluminum, and vent of 0.8 mm (0.032 inch) thick aluminum. Height not to exceed 300 mm (12 inches) above top of roof curb. Design ventilators to withstand 137 Km (85 miles) per hour wind velocity. Provide ventilators with a removable 18 by 18 mesh aluminum wire cloth insect screen.
B. Construct damper of the same material as the ventilator and design to completely close opening or remain wide open. Hold damper in closed position by a brass chain and catch. Extend chains 300 mm (12 inches) below and engage catch when damper is closed.

**2.4 FINISH**

A. In accordance with NAAMM Metal Finishes Manual, unless otherwise specified.
B. Aluminum, Mill Finish: AA-MIX, as fabricated.
C. Aluminum, Clear Finish: AA-C22A41 medium matte, clear anodic coating.
D. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
E. Finish exposed metal surfaces as follows, unless specified otherwise:
   1. Copper: Mill finish.
   2. Stainless Steel: Finish No. 2B or 2D

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. Install roof specialties where shown.
B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
C. Coordinate to install insulation where shown; see Section 07 22 00, ROOF AND DECK INSULATION.
D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.
E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
   b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
   c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
   d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).
J. Equipment Supports: Do not anchor to insulating concrete or metal deck. Anchor only to building structure as per manufacturers recommendations.

**3.2 PROTECTION OF ALUMINUM**

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

**3.3 PROTECTION**

Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

**- - - E N D - - -**

**SECTION 07 92 00**
**JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

**1.2 RELATED WORK:**

A. Masonry Joints: Section 04 20 00 UNIT MASONRY.

B. Roof Insulation: Section 07 22 00 ROOF AND DECK INSULATION.

C. Roof Shingles: Section 07 31 13 ASPHALT SHINGLES; Section 07 32 13 CLAY ROOF TILES.

D. Flat Roofs: Section 07 53 23 ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING.

E. Sheet Metal: Section 07 60 00 FLASHING AND SHEET METAL.

F. Roof Accessories: Section 07 71 00 ROOF SPECIALTIES; 07 72 00 ROOF ACCESSORIES.

**1.3 QUALITY CONTROL:**

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.

2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.

3. Test elastomeric joint sealants according to SWRI’s Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.

4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer’s recommendations:

1. Locate test joints where indicated or, if not indicated, as directed by Contracting Officer.

2. Conduct field tests for each application indicated below:

a. Each type of elastomeric sealant and joint substrate indicated.

b. Each type of non-elastomeric sealant and joint substrate indicated.

3. Notify COTR seven days in advance of dates and times when test joints will be erected.

4. Arrange for tests to take place with joint sealant manufacturer’s technical representative present.

**1.4 SUBMITTALS:**

A. Submit in accordance with Section 01 33 23, SAMPLES AND SHOP DRAWINGS.

B. Manufacturer's installation instructions for each product used.

C. Cured samples of exposed sealants for each color where required to match adjacent material.

D. Manufacturer's Literature and Data:

1. Caulking compound

2. Primers

3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

**1.5 PROJECT CONDITIONS:**

A. Environmental Limitations:

1. Do not proceed with installation of joint sealants under following conditions:

a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 °F.

b. When joint substrates are wet.

B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

**1.6 DELIVERY, HANDLING, AND STORAGE:**

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 90 °F or less than 40 °F.

**1.7 DEFINITIONS:**

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Back-up Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

**1.8 WARRANTY:**

A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction" Article specified in Section, GENERAL CONDITIONS, except that warranty period shall be extended to two years.

B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

**1.9 APPLICABLE PUBLICATIONS:**

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Society for Testing and Materials (ASTM):

| | |
|---|---|
| C509-00 ..... | Elastomeric Cellular Preformed Gasket and Sealing Material. |
| C717-03 ..... | Standard Terminology of Building Seals and Sealants. |
| C834-00 ..... | Latex Sealants. |
| C920-02 ..... | Elastomeric Joint Sealants. |
| C1021-01 ..... | Laboratories Engaged in Testing of Building Sealants |
| C1193-00 ..... | Standard Guide for Use of Joint Sealants. |
| C1330-02 ..... | Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants. |
| D1056-00 ..... | Specification for Flexible Cellular Materials—Sponge or Expanded Rubber. |
| E84-03..... | Surface Burning Characteristics of Building Materials. |

C. Sealant, Waterproofing and Restoration Institute (SWRI).

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**PART 2 - PRODUCTS**

**2.1 SEALANTS:**

A. S-1:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 20-40

B. S-4:

1. ASTM C920 polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-40.

C. S-6:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.
6. Minimum elongation of 1200 percent.

**2.2 CAULKING COMPOUND:**

A. C-1: ASTM C834, acrylic latex.

B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

**2.3 COLOR:**

A. Sealants used with exposed masonry shall match color of brick.

B. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.

C. Caulking shall be light gray or white, unless specified otherwise.

**2.4 JOINT SEALANT BACKING:**

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 °C (minus 26 °F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

**2.5 FILLER:**

A. Mineral fiber board: ASTM C612, Class 1.

B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

**2.6 PRIMER:**

A. As recommended by manufacturer of caulking or sealant material.

B. Stain free type.

**2.7 CLEANERS-NON POUROUS SURFACES:**

A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-pourous surfaces and formulated to promote adhesion of sealant and substrates.

**PART 3 - EXECUTION**

**3.1 INSPECTION:**

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

**3.2 PREPARATIONS:**

A. Prepare joints in accordance with manufacturer's instructions and SWRI.

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.

1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
    a. Concrete.
    b. Masonry.
3. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
    a. Metal.

C. Do not cut or damage joint edges.

D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.

1. Apply primer prior to installation of back-up rod or bond breaker tape.
2. Use brush or other approved means that will reach all parts of joints.

F. Take all necessary steps to prevent three sided adhesion of sealants.

**3.3 BACKING INSTALLATION:**

A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.

D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

F. Take all necessary steps to prevent three sided adhesion of sealants.

**3.4 SEALANT DEPTHS AND GEOMETRY:**

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

**3.5 INSTALLATION:**

A. General:

1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 and 100 degrees F).
2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printer instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool joints to concave surface unless shown or specified otherwise.
8. Apply compounds with nozzle size to fit joint width.
9. Test sealants for compatibility with each other and substrate. Use only compatible sealant.

B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.

1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.

3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.

4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.

5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

**3.6 CLEANING:**

A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.

B. After filling and finishing joints, remove masking tape.

C. Leave adjacent surfaces in a clean and unstained condition.

**3.7 LOCATIONS:**

A. Exterior Building Joints, Horizontal and Vertical:

1. Metal to Metal: Type S-1
2. Metal to Masonry or Stone: Type S-1
3. Masonry to Masonry or Stone: Type S-1
4. Masonry Expansion and Control Joints: Type S-6
5. Wood to Masonry: Type S-1

B. Metal Reglets and Flashings:

1. Flashings to Wall: Type S-6
2. Metal to Metal: Type S-6

**- - -END- - -**

**SECTION 31 20 11**
**EARTH MOVING (SHORT FORM)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

**1.2 DEFINITIONS:**

A. Unsuitable Materials:
   1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
   2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.

B. Earthwork: Earthwork operations required within the new construction area.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in ASTM D698, D1557 Method A.

D. The term fill means fill or backfill as appropriate.

**1.3 RELATED WORK:**

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Safety Requirements: Section, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

**1.4 CLASSIFICATION OF EXCAVATION:**

A. Classified Excavation: Removal and disposal of all material not defined as rock.

**1.5 SUBMITTALS:**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

**1.6 APPLICABLE PUBLICATIONS:**

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Nursery and Landscape Association (ANLA):

2004 .....American Standard for Nursery Stock

C. American Association of State Highway and Transportation Officials (AASHTO):
T99-01 (R2004).....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop
T180-01 (2004) .....Moisture-Density Relations of Soils Using a 4.54-kg [10 lb] Rammer and a 457 mm (18 inch) Drop

D. American Society for Testing and Materials (ASTM):
D698-07 .....Laboratory Compaction Characteristics of Soil Using Standard Effort
D1557-02 .....Laboratory Compaction Characteristics of Soil Using Modified Effort

E. Standard Specifications of (Insert name of local state) State Department of Transportation, latest revision.

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

A. Granular Fill:
1. Under concrete slab, crushed stone or gravel graded from 25 mm (1 inch) to 4.75 mm (No. 4).
2. Bedding for storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No. 4).

B. Fertilizer: (5-10-5) delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

C. Seed: Grass mixture comparable to existing turf delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

D. Sod: Comparable species with existing turf. Use State Certified or State Approved sod when available. Deliver sod to site immediately after cutting and in a moist condition. Thickness of cut must be 19 mm to 32 mm (3/4 inch to 1 1/4 inches) excluding top growth. There shall be no broken pads and torn or uneven ends.

**PART 3 - EXECUTION**

**3.1 SITE PREPARATION:**

A. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile

topsoil and protect as directed by the COTR. Eliminate foreign material, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials, larger than 0.014 m3 (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on the station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.

1. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated.

B. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

**3.2 EXCAVATION:**

A. Shoring, Sheeting and Bracing: Shore, brace, or slope to it's angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.

1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.
2. If the bearing of any foundation is disturbed by excavating, improper shoring or removal of shoring, placing of backfill, and similar operations, provide a concrete fill support under disturbed foundations, as directed by COTR, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by COTR.

B. Excavation Drainage: Operate pumping equipment as required, to keep excavations free of water and subgrades dry, firm, and undisturbed until approval of permanent work has been received from COTR. Approval by the COTR is also required before placement of the permanent work on all subgrades. When subgrade for foundations has been disturbed by water, remove the disturbed material to firm undisturbed material after the water is brought under control. Replace disturbed subgrade in trenches by mechanically tamped sand or gravel.

C. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials, that are determined by the COTR as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the Contractor shall obtain samples of the material, under the direction of the COTR, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed,

the contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on meters (yardage) in cut section only.

D. Finished elevation of subgrade shall be as follows:

1. Pavement Areas - bottom of the pavement or base course as applicable.
2. Planting and Lawn Areas - 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

**3.3 FILLING AND BACKFILLING:**

A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by COTR.

B. Proof-rolling Existing Subgrade: Remove unstable uncompactable material and replace with granular fill material completed to mix requirements specified.

C. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.

**3.4 GRADING:**

A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

B. Cut rough or sloping rock to level beds for foundations. In unfinished areas fill low spots and level off with coarse sand or fine gravel.

C. Slope backfill outside the building away from the building walls for a minimum distance of 3048 mm (10 feet)at a minimum five percent (5%) slope.

D. The finished grade shall be 150 mm (6 inches) below bottom line of windows or other building wall openings unless greater depth is shown.

E. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 150 mm (6 inches), unless otherwise indicated.

F. Finish subgrade in a condition acceptable to the COTR at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

G. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

**3.5 LAWN AREAS:**

A. General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by COTR before seeding or sodding operation begins.

B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.

C. Fertilizing: Incorporate fertilizer into the soil to a depth of 100 mm (4 inches) at a rate of 12 kg/100 m2 (25 pounds per 1000 square feet).

D. Seeding: Seed at a rate of 2 kg/100 m2 (4 pounds per 1000 square feet) and accomplished only during periods when uniform distribution may be assured. Lightly rake seed into bed immediately after seeding. Roll seeded area immediately with a roller not to exceed 225 kg/m (150 pounds per foot) of roller width.

E. Sodding: Topsoil shall be firmed by rolling and during periods of high temperature the topsoil shall be watered lightly immediately prior to laying sod. Sod strips shall be tightly butted at the ends and staggered in a running bond fashion. Placement on slopes shall be from the bottom to top of slope with sod strips running across slope. Secure sodded slopes by pegging or other approved methods. Roll sodded area with a roller not to exceed 225 kg/m (150 pounds per foot) of the roller width to improve contact of sod with the soil.

F. Watering: As seeding/sodding is completed in any one section, the entire seeded/sodded area shall be thoroughly irrigated by the contractor, to a sufficient depth, that the underside of the new sod pad and soil, immediately below sod, is thoroughly wet.

**3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:**

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.

B. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

**3.7 CLEAN-UP:**

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Medical Center Property.

**- - - E N D - - -**

**SECTION 32 05 23**
**CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS**

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown. Construction shall include the following:

B. Pedestrian Pavement: Walks, grade slabs.

### 1.2 RELATED WORK

A. Concrete Materials, Quality, Mixing, Design and Other Requirements: Section 03 30 00, CAST-IN-PLACE-CONCRETE.

### 1.3 DESIGN REQUIREMENTS

Design all elements with the latest published version of applicable codes.

### 1.4 WEATHER LIMITATIONS

Placement of concrete shall be as specified under Article 3.4 of Section 03 30 00, CAST-IN-PLACE CONCRETE.

### 1.5 SELECT SUBBASE MATERIAL JOB-MIX

The Contractor shall retain and reimburse a testing laboratory to design a select subbase material mixture and submit a job-mix formula to the Project Engineer, in writing, for approval. The formula shall include the source of materials, gradation, plasticity index, liquid limit, and laboratory compaction curves indicating maximum density at optimum moisture.

### 1.6 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.

1. Expansion joint filler
2. Hot poured sealing compound
3. Reinforcement
4. Curing materials

C. Data and Test Reports: Select subbase material.

1. Job-mix formula.
2. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.

**1.7 APPLICABLE PUBLICATIONS**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.

B. American Association of State Highway and Transportation Officials (AASHTO):

M31 .....Deformed and Plain Billet Steel Bars for Concrete Reinforcement (ASTM A615/A615M-96A)

M55M/55M .....Welded Steel Wire Fabric for Concrete Reinforcement (ASTM A185)

M147 .....Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses (R 1996)

M148 .....Liquid Membrane-Forming Compounds for Curing Concrete (ASTM C309A)

M171 .....Sheet Materials for Curing Concrete (ASTM C171

M182 .....Burlap Cloth Made from Jute or Kenaf

M213 .....Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Type) (ASTM D1751)

T99 .....Moisture-Density Relations of Soils Using a 2.5 kg. (5.5 lb) Rammer and a 305 mm (12 in.) Drop

T180 .....Moisture-Density Relations of Soils Using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

C. American Society for Testing and Materials (ASTM):

C94/C94M .....Ready-Mixed Concrete

C143/C143M .....Slump of Hydraulic Cement Concrete

**PART 2 - PRODUCTS**

**2.1 GENERAL**

Concrete shall be Type C, air-entrained as specified in Section 03 30 53, (Short Form)CAST-IN-PLACE CONCRETE, with the following exceptions:

| TYPE | MAXIMUM SLUMP* |
|---|---|
| Pedestrian Walks | 75 mm (3") |
| | |
| * For concrete to be vibrated: Slump as determined by ASTM C143. Tolerances as established by ASTM C94. | |

**2.2 REINFORCEMENT**

A. The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.

B. Welded wire-fabric shall conform to AASHTO M55.

C. Dowels shall be plain steel bars conforming to AASHTO M31 or M42. Tie bars shall be deformed steel bars conforming to AASHTO M31 or M42.

**2.3 SELECT SUBBASE**

A. Subbase material shall consist of select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials conforming to AASHTO M147, Grading E or F.

B. Subbase material shall produce a compacted, dense-graded course, meeting the density requirement specified herein.

**2.4 FORMS**

A. Use metal or wood forms that are straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating the concrete, for the work involved.

B. Do not use forms if they vary from a straight line more than 3 mm (1/8 inch) in any 3000 mm (ten foot) long section, in either a horizontal or vertical direction.

C. Wood forms should be at least 50 mm (2 inches) thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects.

**2.5 CONCRETE CURING MATERIALS**

A. Concrete curing materials shall conform to one of the following:

1. Liquid Membrane Curing Compound conforming to AASHTO M148 (ASTM C309), Type 1 and shall be free of paraffin or petroleum.

**2.6 EXPANSION JOINT FILLERS**

Material shall conform to AASHTO M213.

**PART 3 - EXECUTION**

**3.1 SUBGRADE PENETRATION**

Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

**3.2 SELECT SUBBASE**

A. Mixing: Proportion the select sub-base by weight or by volume in quantities so that the final approved job mixed formula gradation, liquid limit, and plasticity index requirements will be met after sub-base course has been placed and compacted. Add water in approved quantities, measured by weight or volume, in such a manner to produce a uniform blend.

B. Placing:

1. Place the mixed material on the prepared sub-grade in a uniform layer to the required contour and grades, and to a loose depth not to exceed 200 mm (8 inches), and that when compacted, will produce a layer of the designated thickness.
2. When the designated compacted thickness exceeds 150 mm (6 inches), place the material in layers of equal thickness. Remove unsatisfactory areas and replace with satisfactory mixture, or mix the material in the area.
3. In no case will the addition of thin layers of material be added to the top layer in order to meet grade.
4. If the elevation of the top layer is 13 mm (1/2 inch) or more below the grade, excavate the top layer and replace with new material to a depth of at least 75 mm (3 inches) in compacted thickness.

C. Compaction:
1. Perform compaction with approved equipment (hand or mechanical) well suited to the material being compacted.
2. Moisten or aerate the material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.
3. Compact each layer to at least 95 percent or 100 percent of maximum density as determined by AASHTO T180 or AASHTO T99 respectively.

D. Smoothness Test and Thickness Control:
Test the completed sub-base for grade and cross section with a straight edge.
1. The surface of each layer shall not show any deviations in excess of 10 mm (3/8 inch).
2. The completed thickness shall be within 13 mm (1/2 inch) of the thickness as shown.

E. Protection:
1. Maintain the finished sub-base in a smooth and compacted condition until the concrete has been placed.
2. When Contractor's subsequent operations or adverse weather disturbs the approved compacted subbase, excavate, and reconstruct it with new material meeting the requirements herein specified, at no additional cost to the VA.

**3.3 SETTING FORMS**

A. Base Support:
1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.

B. Form Setting:
1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.

2. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.
3. Forms shall conform to line and grade with an allowable tolerance of 3 mm (1/8 inch) when checked with a straightedge and shall not deviate from true line by more than 6 mm (1/4 inch) at any point.
4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
5. Clean and oil forms each time they are used.

**3.4 EQUIPMENT**

A. The Project Engineer shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.

B. Maintain equipment and tools in satisfactory working condition at all times.

**3.5 PLACING REINFORCEMENT**

A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.

B. Before the concrete is placed, the Project Engineer shall approve the reinforcement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown.

**3.6 PLACING CONCRETE - GENERAL**

A. Obtain approval of the Project Engineer before placing concrete.

B. Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the Project Engineer before placing concrete.

C. Before the concrete is placed, uniformly moisten the subgrade, base, or subbase appropriately, avoiding puddles of water.

D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.

E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.

F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.

**3.7 PLACING CONCRETE PEDESTRIAN PAVEMENT**

A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.

B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.
C. After the concrete has been placed in the forms, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted.
D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
E. Finish the surface to grade with a wood or metal float.
F. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.

**3.8 CONCRETE FINISHING - GENERAL**

A. The sequence of operations, unless otherwise indicated, shall be as follows:
1. Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.
2. Maintain finishing equipment and tools in a clean and approved condition.

**3.9 CONCRETE FINISHING PEDESTRIAN PAVEMENT**

A. Walks, Grade Slabs:
1. Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.
2. Brooming shall be transverse to the line of traffic.
3. Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.
4. Unless otherwise indicated, edge the transverse joints before brooming. The brooming shall eliminate the flat surface left by the surface face of the edger. Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 2 mm (1/16 inch) in depth.
5. The completed surface shall be uniform in color and free of surface blemishes, form marks, and tool marks. The finished surface of the pavement shall not vary more than 5 mm (3/16 inch) when tested with a 3000 mm (10 foot) straightedge.
6. The thickness of the pavement shall not vary more than 6 mm (1/4 inch).
7. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

**3.10 JOINTS - GENERAL**

A. Place joints, where shown, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface.
B. Joints shall be straight and continuous from edge to edge of the pavement.

**3.11 CONTRACTION JOINTS**

A. Cut joints to depth as shown with a grooving tool or jointer of a radius as shown or by sawing with a blade producing the required width and depth.

B. Construct joints in curbs by inserting 3 mm (1/8 inch) steel plates conforming to the cross sections of the curb.
C. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.
D. Finish edges of all joints with an edging tool having the radius as shown.
E. Score pedestrian pavement with a standard grooving tool or jointer.

**3.12 EXPANSION JOINTS**

A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.
B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished concrete surface where shown to allow for sealing.
C. Anchor with approved devices to prevent displacing during placing and finishing operations.
D. Round the edges of joints with an edging tool.
E. Form expansion joints as follows:
    1. Without dowels, about structures and features that project through, into, or against any site work concrete construction.
    2. Using joint filler of the type, thickness, and width as shown.
    3. Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.

**3.13 CONSTRUCTION JOINTS**

A. Locate transverse construction joints between slabs of vehicular pavement as shown.
B. Place transverse construction joints of the type shown, where indicated and whenever the placing of concrete is suspended for more than 30 minutes.
C. Use a butt-type joint with dowels in curb if the joint occurs at the location of a planned joint.

**3.14 FORM REMOVAL**

A. Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.
B. Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal.

**3.15 CURING OF CONCRETE**

A. Liquid Membrane Curing:
    1. Apply pigmented membrane-forming curing compound in two coats at right angles to each other at a rate of 5 $m^2$/L (200 square feet per gallon) for both coats.
    2. Do not allow the concrete to dry before the application of the membrane.

3. Cure joints designated to be sealed by inserting moistened paper or fiber rope or covering with waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint.
4. Immediately re-spray any area covered with curing compound and damaged during the curing period.

**3.16 CLEANING**

A. After completion of the curing period:
   1. Remove the curing material (other than liquid membrane).
   2. Sweep the concrete clean.
   3. After removal of all foreign matter from the joints, seal joints as herein specified.
   4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

**3.17 PROTECTION**

The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the Project Engineer, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the COTR

**3.18 FINAL CLEAN-UP**

Remove all debris, rubbish and excess material from the Station.

**- - - E N D - - -**

**SECTION 32 12 16**
**ASPHALT PAVING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This work shall cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement. The hot asphalt concrete pavement shall consist of an aggregate or asphalt base course and asphalt surface course constructed in conformity with the requirements of 4" ODOT # 304 specifications.

**1.2 RELATED WORK**

Laboratory and field testing requirements: Section 01 45 29, TESTING LABORATORY SERVICES.

**1.3 INSPECTION OF PLANT AND EQUIPMENT**

The COTR shall have access at all times to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

**1.4 SUBMITTALS**

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

B. Data and Test Reports:

1. Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by State Highway Department.
2. Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by State Highway Department.
3. Job-mix formula.

C. Certifications:

1. Asphalt prime and tack coat material certificate of conformance to State Highway Department requirements.
2. Asphalt cement certificate of conformance to State Highway Department requirements.
3. Job-mix certification: Submit plant mix certification that mix equals or exceeds the State Highway Specification.

D. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

Aggregate base and asphalt concrete materials shall conform to the requirements of the following and other appropriate sections of the latest version of the State Highway Material Specifications, including amendments, addenda and errata. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it shall mean the VA COTR.

**2.2 AGGREGATES**

A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable mineral materials processed and blended, and naturally combined.

B. Subbase aggregate (where required) maximum size: 38mm(1-1/2").

C. Base aggregate maximum size:

1. Base course over 152mm(6") thick: 38mm(1-1/2");
2. Other base courses: 19mm(3/4").

D. Asphaltic base course:

1. Maximum particle size not to exceed 25.4mm(1”).
2. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

E. Aggregates for asphaltic concrete paving: Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions that the percentage by weight will be within:

| Sieve Sizes | Percentage Passing |
|---|---|
| 19mm(3/4") | 100 |
| 9.5mm(3/8") | 67 to 85 |
| 6.4mm(1/4") | 50 to 65 |
| 2.4mm(No. 8 mesh) | 37 to 50 |
| 600µm(No. 30 mesh) | 15 to 25 |
| 75µm(No. 200 mesh) | 3 to 8 |

plus 50/60 penetration liquid asphalt at 5 percent to 6-1/2 percent of the combined dry aggregates.

**2.3 ASPHALTS**

A. Comply with provisions of Asphalt Institute Specification SS2:

1. Asphalt cement: Penetration grade 50/60
2. Prime coat: Cut-back type, grade MC-250
3. Tack coat: Uniformly emulsified, grade SS-1H

**2.4 SEALER**

A. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers having a container consistency suitable for troweling after thorough stirring, and containing no clay or other deleterious substance.

B. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

**PART 3 - EXECUTION**

**3.1 GENERAL**

The Asphalt Concrete Paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

**3.2 MIXING ASPHALTIC CONCRETE MATERIALS**

A. Provide hot plant-mixed asphaltic concrete paving materials.
   1. Temperature leaving the plant: 143 degrees C(290 degrees F) minimum, 160 degrees C(320 degrees F) maximum.
   2. Temperature at time of placing: 138 degrees C(280 degrees F) minimum.

**3.3 SUBGRADE**

A. Shape to line and grade and compact with self-propelled rollers.
B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.
C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.
D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.
E. Proof-roll the subgrade with maximum 45 tonne (50 ton) gross weight dump truck as directed by VA Resident Engineer or VA Contracting Officer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

**3.4 BASE COURSES**

A. Base
   1. Spread and compact to the thickness to match original.
   2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
   3. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.
B. Thickness tolerance: Provide the compacted thicknesses to match original within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").
C. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet).
D. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

**3.5 PLACEMENT OF ASPHALTIC CONCRETE PAVING**

A. Remove all loose materials from the compacted base.
B. Apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacturer’s recommendations as approved by the COTR.

C. Receipt of asphaltic concrete materials:
   1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C(280 degrees F).
   2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.

D. Spreading:
   1. Spread material in a manner that requires the least handling.
   2. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.

E. Rolling:
   1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown own the drawings.
   2. Roll in at least two directions until no roller marks are visible.
   3. Finished paving smoothness tolerance:
      a. No depressions which will retain standing water.
      b. No deviation greater than 3mm in 1.8m (1/8" in six feet).

**3.6 APPLICATION OF SEAL COAT**

A. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.

B. Apply one coat of the specified sealer.

C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

**3.7 PROTECTION**

Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

**3.8 FINAL CLEAN-UP**

Remove all debris, rubbish, and excess material from the work area.

**- - - E N D - - -**

**SECTION 33 40 00**

**STORM SEWER UTILITIES**

## PART 1 - GENERAL

### 1.1 DESCRIPTION

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

### 1.2 RELATED WORK

A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 11, EARTH MOVING (Short Form).

B. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 00, CAST-IN-PLACE CONCRETE.

C. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

### 1.3 ABBREVIATIONS

A. HDPE: High-density polyethylene

B. PE: Polyethylene

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe, and fittings in direct sunlight.

### 1.5 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

### 1.6 SUBMITTALS

A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

### 1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

A185/A185M-07 .....Steel Welded Wire Reinforcement, Plain, for Concrete

A242/A242M-04(2009).....High-Strength Low-Alloy Structural Steel

A536-84(2009) ..... Ductile Iron Castings

A615/A615M-09b ..... Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

A760/A760M-10 ..... Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains

A798/A798M-07 ..... Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications

A849-10..... Post-Applied Coatings, Paving, and Linings for Corrugated Steel Sewer and Drainage Pipe

A929/A929M-01(2007)..... Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe

B745/B745M-97(2005)..... Corrugated Aluminum Pipe for Sewers and Drains

B788/B788M-09 ..... Installing Factory-Made Corrugated Aluminum Culverts and Storm Sewer Pipe

C14-07 ..... Non-reinforced Concrete Sewer, Storm Drain, and Culvert Pipe

C33/C33M-08..... Concrete Aggregates

C76-11 ..... Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

C139-10 ..... Concrete Masonry Units for Construction of Catch Basins and Manholes

C150/C150M-11..... Portland Cement

C443-10 ..... Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

C478-09 ..... Precast Reinforced Concrete Manhole Sections

C506-10b ..... Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe

C507-10b ..... Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe

C655-09 ..... Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe

C857-07 ..... Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

C891-09 ..... Installation of Underground Precast Concrete Utility Structures

C913-08 ..... Precast Concrete Water and Wastewater Structures

C923-08 .....Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

C924-02(2009) .....Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

C990-09 .....Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

C1103-03(2009) .....Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

C1173-08 .....Flexible Transition Couplings for Underground Piping Systems

C1433-10 .....Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers

C1479-10 .....Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations

D448-08 .....Sizes of Aggregate for Road and Bridge Construction

D698-07e1 .....Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))

D1056-07 .....Flexible Cellular Materials—Sponge or Expanded Rubber

D1785-06 .....Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D2321-11 .....Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2751-05 .....Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings

D2774-08 .....Underground Installation of Thermoplastic Pressure Piping

D3034-08 .....Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

D3350-10 .....Polyethylene Plastics Pipe and Fittings Materials

D3753-05e1 .....Glass-Fiber-Reinforced Polyester Manholes and Wetwells

D4101-11 .....Polypropylene Injection and Extrusion Materials

D5926-09 .....Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679-08 ..... Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

F714-10 ..... Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

F794-03(2009) ..... Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

F891-10 ..... Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core

F894-07 ..... Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

F949-10 ..... Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

F1417-11 ..... Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

F1668-08 ..... Construction Procedures for Buried Plastic Pipe

C. American Association of State Highway and Transportation Officials (AASHTO):

M190-04 ..... Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches

M198-10 ..... Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

M252-09 ..... Corrugated Polyethylene Drainage Pipe

M294-10 ..... Corrugated Polyethylene Pipe, 12 to 60 In. (300 to 1500 mm) Diameter

D. American Water Works Association(AWWA):

C105/A21.5-10 ..... Polyethylene Encasement for Ductile iron Pipe Systems

C110-08 ..... Ductile-Iron and Gray-Iron Fittings

C219-11 ..... Bolted, Sleeve-Type Couplings for Plain-End Pipe

C600-10 ..... Installation of Ductile iron Mains and Their Appurtenances

C900-07 ..... Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution

M23-2nd ed .....PVC Pipe "Design And Installation"

E. American Society of Mechanical Engineers (ASME):

A112.6.3-2001.....Floor and Trench Drains

A112.14.1-2003.....Backwater Valves

A112.36.2M-1991.....Cleanouts

F. American Concrete Institute (ACI):

318-05 .....Structural Commentary and Commentary

350/350M-06 .....Environmental Engineering Concrete Structures and Commentary

G. National Stone, Sand and Gravel Association (NSSGA): Quarried Stone for Erosion and Sediment Control

**1.8 WARRANTY**

The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturers' and suppliers' written guarantees and warranties covering materials and equipment furnished under this Contract.

**PART 2 - PRODUCTS**

**2.1 FACTORY-ASSEMBLED PRODUCTS**

A. Standardization of components shall be maximized to reduce spare part requirements. The Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

**2.2 ABS PIPE AND FITTINGS**

A. ABS Sewer Pipe and Fittings: Pipe and fittings shall conform to ASTM D2751, with bell-and-spigot ends for gasketed joints.

1. NPS 3 to NPS 6 (DN 80 to DN 150): SDR 35.
2. NPS 8 to NPS 12 (DN 200 to DN 300): SDR 42.

B. Gaskets: ASTM F477, elastomeric seals.

**2.3 PIPE AND FITTINGS**

A. PVC Pipe And Fittings

1. PVC Cellular-Core Pipe And Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D3034, SDR 35, PVC socket-type fittings.

B. PVC Gravity Sewer Piping

1. Pipe and fittings shall be ASTM F679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends.
2. Gaskets: ASTM F477, elastomeric seals for gasketed joints.

**2.4 NONPRESSURE TRANSITION COUPLINGS**

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials

1. For plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
2. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with // stainless-steel shear ring and // corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

**2.5 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS**

A. Resilient connectors and downspout boots: Flexible, watertight connectors used for connecting pipe to manholes and inlets, and shall conform to ASTM C923.

**PART 3 - EXECUTION**

**3.1 PIPE BEDDING**

A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321.

**3.2 PIPING INSTALLATION**

A. Drawing plans indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping with 36 inch (915 mm) minimum cover.

C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.

2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install PVC cellular-core piping, PVC sewer piping, and PVC profile gravity sewer piping, according to ASTM D2321 and ASTM F1668.

**3.3 CONNECTIONS TO EXISTING VA MANHOLES**

A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the exisitng manholes, including concrete and masonry work, cutting, and shaping.

**3.4 FIELD QUALITY CONTROL**

A. Inspect interior of piping to determine whether line displacement or other damage has occurred.

1. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Damage: Crushed, broken, cracked, or otherwise damaged piping.
2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
3. Reinspect and repeat procedure until results are satisfactory.

**3.5 CLEANING**

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

**--- E N D ---**